SCIENCE DIGEST

OCTOBER 1967 · 50 CENTS ICD

10 SMARTEST ANIMALS

Success—
what it demands
what it costs

To the planets
for GOLD

Mystery of the
Easter Island
heads—new clues

SPECIAL—
Exotic fuels will
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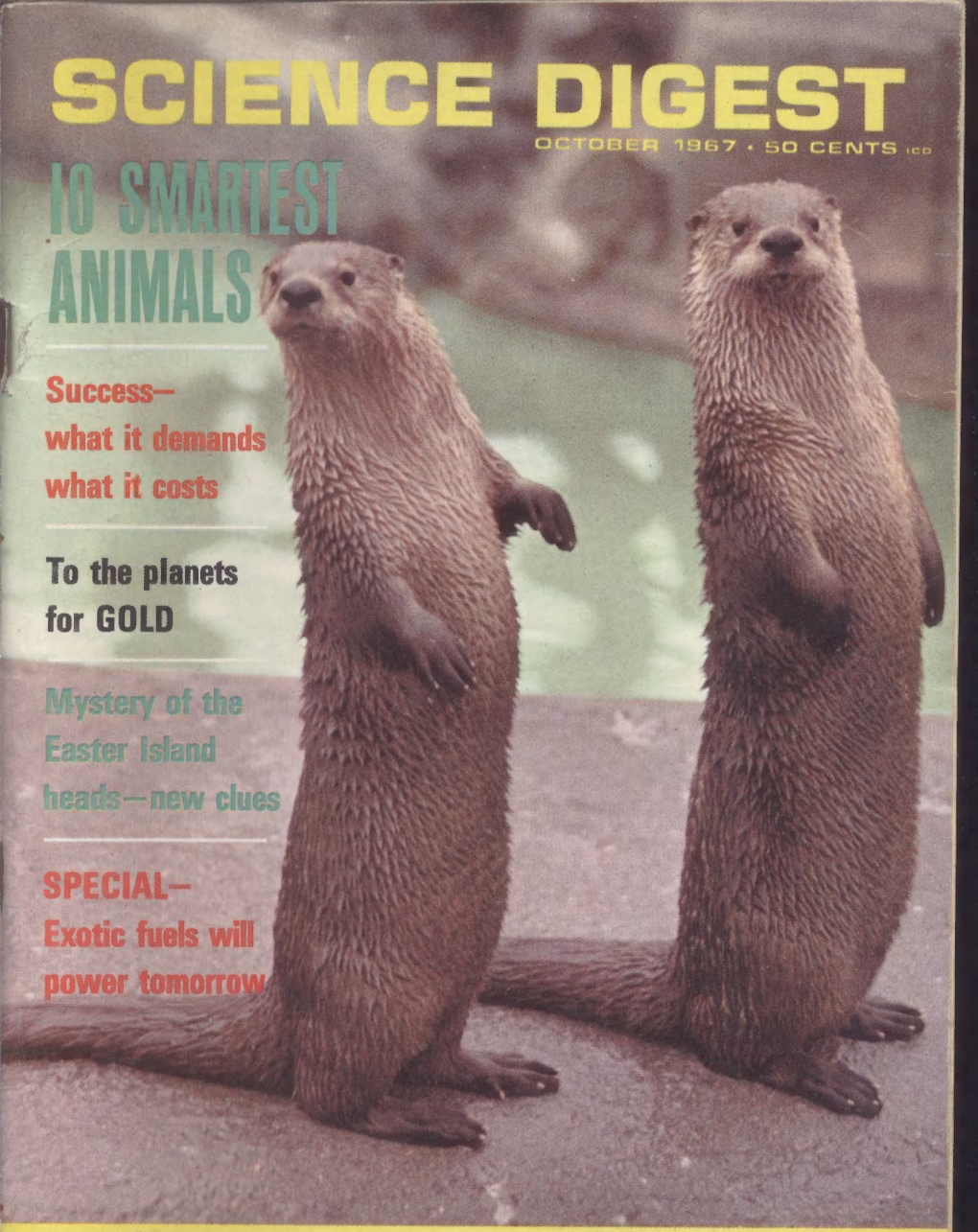

The Aegean gives up a secret— new Atlantis theory

6 science tricks
you can perform

War against asthma—
we're winning it

Most snake-bitten
man in the world

A macropus by any other name

BEING named for the size of your feet might be humiliating —unless you're a kangaroo. And for the former pretty-face wallaby, being dubbed *Macropus parryi* or Parry's kangaroo is a real hike in status. Traditional taxonomy had it that only marsupials with a hind foot length of 10 or more inches could qualify for the kangaroo genus. So, the macropod (*macro*—big, *pod*—foot) with its six-to-10-inch foot was consigned to the *Wallabia* or kangaroo-like animal category until recently, when it was decided that this striped-cheeked marsupial really resembled kangaroos more closely than wallabies. Hence, it's name has been changed to Parry's kangaroo (for Sir Edward Parry, famous Arctic explorer who, after his stay in Australia, brought one of the silver-colored animals back to England). It's still a hill dweller, nocturnal in its habits, venturing downhill to grazing land and water only at night.

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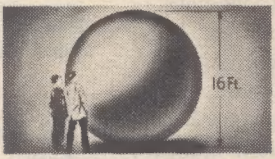

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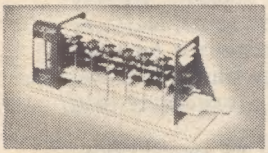

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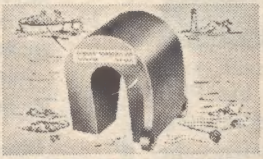

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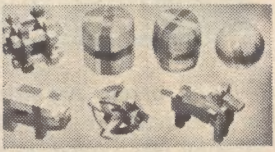

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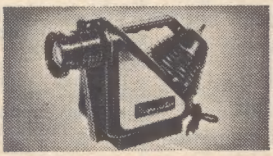

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OUR famous "explainer", Isaac Asimov, is back in the news. At 47, his 96th book is off the press. We'll review it next month.

For more than two years, Dr. Asimov has been writing our lead "Please Explain" item each month (On page 84 he explains, how life on earth began—from memory, presumably, since most of the facts he pours out come right off the top of his remarkable brain with astounding accuracy).

THIS MONTH

Long before acquiring his PhD. in chemistry at Columbia in 1948, Asimov was famed as a science fiction writer. Since then, he has proliferated a bevy of highly regarded textbooks on everything from the moon to mathematics. A layman's book on math, entitled *The Realm of Numbers,* was produced in 13 days. When we asked him if he could explain Relativity in a 500 word piece, he assured us he could —and did. He called me to say: "It's right. But it's sort of like touring Russia in a day and a half."

Dr. Asimov holds the title of associate professor of biochemistry at Boston University School of Medicine, and he still lectures between books and articles that flow from his typewriter as though it were hitched to a computer. He promised to do us a feature soon. I'm sure he will, as soon as he can clear the decks for half an hour.—*RFD*

news, knowledge, advice

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SCIENCE DIGEST is published monthly by The Hearst Corporation, 959 Eighth Avenue, New York, N.Y., 10019. RICHARD E. BERLIN, *President;* GEORGE HEARST, *V-Pres.;* RICHARD E. DEEMS, *President of Magazines;* JOHN R. MILLER, *Executive V-Pres., Magazines;* WILLIAM S. CAMPBELL, *V-Pres. and Director of Circulation;* RAYMOND J. PETERSEN, *Senior V-Pres. of Magazines;* FRANK MASSI, *Treas.;* HARVEY L. LIPTON, *Sec.*

These bright-eyed otters look intelligent, and they are. So are many other animals. In fact, science is beginning to discover just how bright many animals are. A report and engaging photo story on the world's smartest animals begins on page 20.

Photo by Russ Kinne

DIGEST

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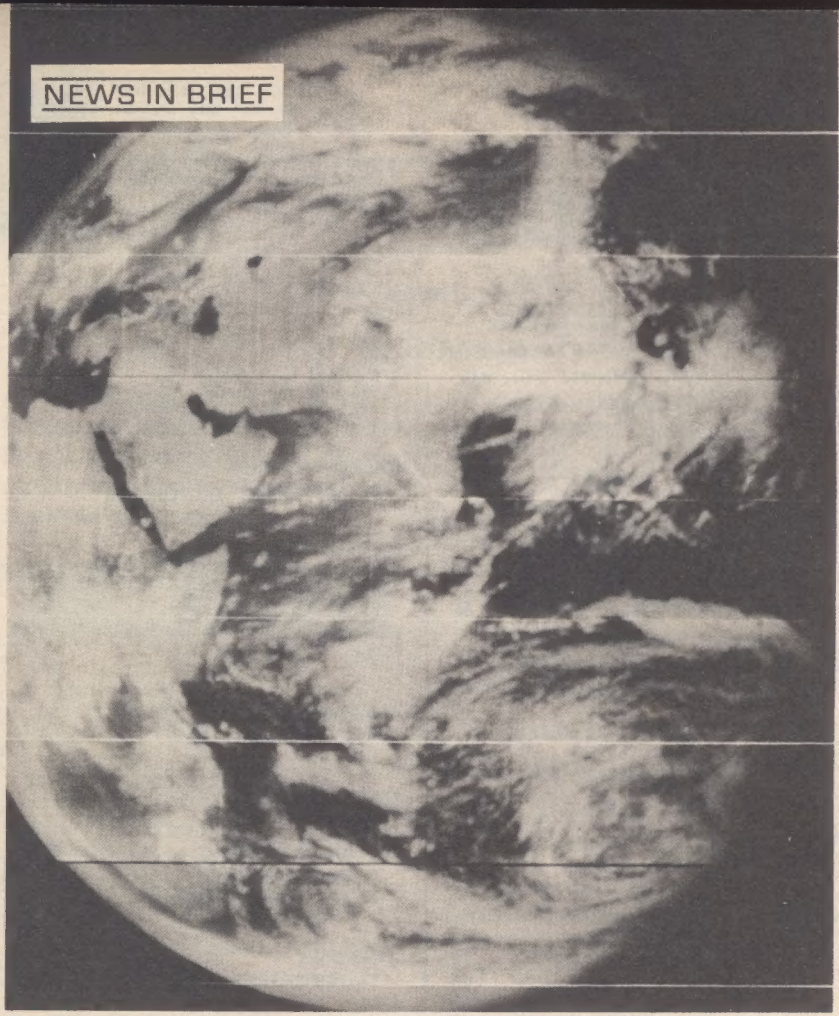


Bulletins at press time

EARTH FROM THE MOON. Lunar Orbiter 5 took the above photo of the earth from a distance of 214,806 miles. At the time the space vehicle was 3,640 miles above the surface of the moon. The photo shows about five-sixths of the earth's face including the east coast of Africa, Italy, Greece, Turkey, the Red Sea, the Arabian Peninsula and the Suez Canal region. India can be seen through the clouds at the center of the photo, but clouds obscure most of Asia. The North Polar Region is near the top.

BOOST FOR INTERFERON. Interferon is a substance produced by the human body which protects it against a broad range of virus-caused diseases. Recent discoveries have moved scientists closer to discovering how to stimulate the body to production of this protective material. They have found that a particular form of RNA triggers the production of interferon. Ultimately such a discovery could have major public health implications.

CIGARETTES INDICTED AGAIN. A new government report says that more than 2,000 research studies published since the 1964 Surgeon General's report on smoking "confirm and strengthen" the earlier report's conclusions that cigarette smoking is a serious hazard to health.

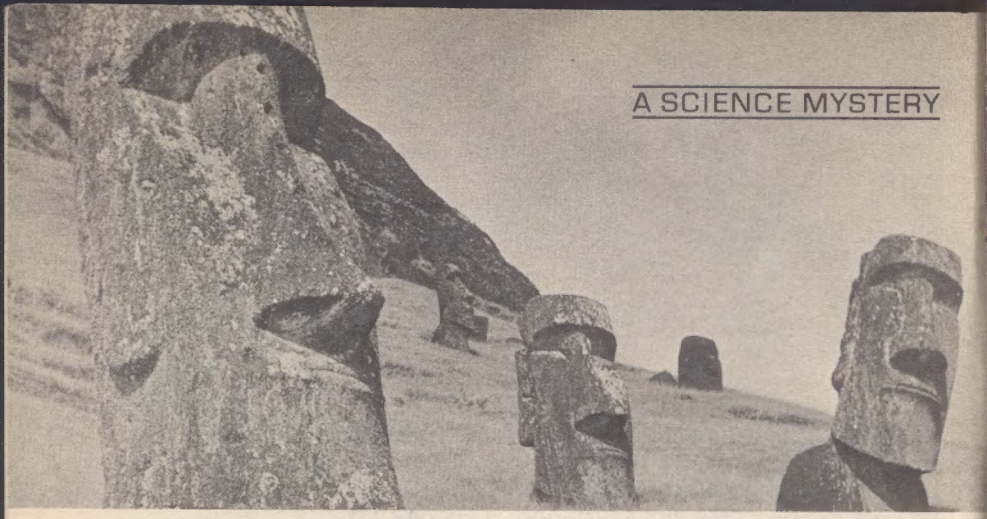
U.S. IDENTIFIES STP. STP, a powerful mind-distorting drug, and new craze among drug taking young people has been identified as an experimental compound developed by a major chemical company. No one yet seems to know how the drug got into unauthorized hands. It had been sent to a few scientific investigators for further tests.

AUTO SAFETY STANDARDS LOWERED. The government has modified the auto safety standards issued earlier for vehicles produced on and after Jan. 1. Requirements for extra knee and leg impact protection, and changes of interior handles and knobs have been dropped.

AGE OF UNIVERSE. Two Soviet astrophysicists have estimated that the universe may be 70 billion years old, seven times as old as generally assumed. They developed this hypothesis after a study of quasars.

NYLON ARMOR. A seatbelt manufacturer has developed a woven nylon material that is supposed to be more effective than standard titanium-lined flack jackets at stopping bullets.

TINY TV ANTENNA. Electronics companies all over the country are rushing to develop a commercial miniaturized TV aerial based on the devise developed four years ago by the Air Force. Hopes are that the aerial could be built right into the set.



Isle of eyeless watchers:

The huge 'heads' of remote Easter Island have fascinated people for centuries. Who built the awesome statues? What purpose did they serve?

by L. Sprague de Camp

ONE of the loneliest places on earth is Easter Island, or Rapa Nui as its dwellers call it. One must travel 2,200 miles eastward to reach the South American coast; or, in the other direction, 1,200 miles to find Pitcairn Island. The desolate isolation of Easter Island makes its ruins all the more astonishing.

From the sea, the island appears as a green, grassy land, rolling away behind tall, black cliffs. It is roughly triangular, about 35 miles around, with an area of 45 square miles. Near the points of the triangle stand the cones of three extinct volcanoes: Rano Raraku, Rano Kao and Rano Aroi. Smaller cones rise elsewhere. The climate is mild and windy, with gusty rains. There are no native mammals, but insects are bothersome.

The soil of Rapa Nui is decomposed lava, fertile but very porous. Hence the island has no rivers and only a few springs. The natives had to work hard to clear stones from their fields and to carry water to irrigate their simple crops, mainly sweet potatoes.

The island is famous for its huge-headed statues. Although many have been taken away to museums, or have been used for building materials, or have fallen into the sea, there are still over 600 of them on Rapa Nui. Completed statues range from 3 to 36 feet in height. Some larger ones, up to 66 feet long, were begun in the quarry of Rano Rara-

ku but never finished. These sculptures, although often called "heads" or "busts", are for the most part complete statues. The size of the heads, however, is so exaggerated in proportion to the squat bodies that the latter pass unnoticed.

The Dutch admiral Jaakob Roggeveen landed on Rapa Nui on Easter Sunday, 1722, and named the place Paasch Eyland or Easter Island; hence the name "Pascuans" for the Easter Islanders. These people are Polynesians—big, handsome folk with brown skins and straight or wavy black hair. They speak a dialect of the Marquesan language of the Polynesian family, and nowadays they also know Spanish. They farm, fish, and work on the sheep ranch run by the Chilean government. They wear cast-off western-style clothing, some of it stolen from visitors.

Scientists, adventurers and cultists have all tried to solve the problem of how and when these folk came to Easter Island. Some have said that Rapa Nui was the remnant of a sunken Pacific continent, or that it was once joined by a land bridge to other land masses. Geology has, however, completely discredited such ideas. Others have asserted that the island was settled by venturesome Vikings from Scandinavia via Peru, although there is nothing in the racial type or the language of the Pascuans to suggest such an origin.

Scientists are now convinced that the Pascuans are of purely Polynesian origin, and that the Polynesians once lived along the southeast coasts of Asia. The rise of a powerful Chinese Empire in the second millennium B.C. touched off a general movement of peoples. Each tribe on the fringes of Chinese civilization, fleeing advancing Chinese imperialism, crowded its neighbors outward. Because the Polynesians were already spread along the coast, they could go nowhere but across the sea. Their exact route to the Polynesian islands is being gradually revealed by archaeology. Language, culture, and archaeology all indicate that the Pascuans came to their present home from the Marquesas Islands.

The Polynesians, the most accomplished of all barbarian seafarers, may have occasionally reached the coast of South America. It is less likely—although not entirely impossible—that any Peruvian Indians ever got to Polynesia. There may have been many such unrecorded transoceanic voyages in the history of mankind.

In the vast majority of cases, however, the voyagers probably perished, either on the voyage, or at the time of landing, or soon thereafter, without leaving any trace of their voyage. The best they could hope for would be that a local tribe, instead of instantly killing and perhaps eating them, would take them in. But, to survive, the voyagers would have to adopt the ways of the locals, and not vice versa. L i v i n g on suffrance in strange surroundings where most of their previous knowledge would be

useless, they could not be "enlighteners" of their hosts.

Early in this century, Juan Tepano, a Pascuan who collected tribal lore, told the following tradition of the settlement of Rapa Nui:

The land of our fathers was a great island to the west called Marae Ranga. The climate was warm and many trees grew there, of which our ancestors made large boats or gathered together to build themselves houses. . .

Hotu Matu'a was a chief of this island, but he was forced to leave it after a quarrel with his brother Te Ira-ka-tea.

Seen in a dream

There was in the island a certain Hau Maka, who had tattooed King Hotu Matu'a. Hau Maka had a dream: his soul journeyed across the sea to an island where there were holes [craters] and fine beaches . . . Hotu Matu'a understood that Hau Maka's dream was a promise. He chose six men, gave them a canoe, and told them to sail straight ahead until they reached the land Hau Maka's soul had seen.

The pioneers found Rapa Nui, and Hotu Matu'a followed close behind.

For a defeated Polynesian chief to set out with his henchmen to look for new land was usual; otherwise he was liable to be eaten by the victors. While most such expeditions perished at sea, some succeeded, and thus the isles were peopled. The so-called Polynesian "canoes" were sailing catamarans up to 150 feet long, carrying up to 400 people. Radiocarbon dates show that the settlement of the western Polynesian islands began several centuries before the Christian Era, and of Rapa Nui not later than the ninth century of this era and possibly several centuries earlier.

In the millennium following the settlement of Rapa Nui, the Pascuans farmed, fished, fought tribal wars, carved hundreds of awesome statues, and then saw their culture crushed by the all-conquering white man.

In 1576, the Spanish seaman Juan Fernández reported land in the area of Rapa Nui; in 1687 an English buccaneer, Edward Davis, made a similar report. In 1722 came Admiral from Roggeveen. Naked natives came aboard bearing food. When they had presented their gifts, they stole whatever they could lay their hands on, including several sailors' caps and the admiral's tablecloth, and dived overboard.

When Roggeveen sent a party ashore, hundreds of Pascuans gathered on the beach. Some made friendly gestures; others threatened the visitors. When they began throwing stones, a volley of musketry littered the sand with dead and wounded. The Pascuans scattered but soon returned with servile gestures. A few hours later, Roggeveen sailed away.

In 1774, Captain Cook arrived. To him the Pascuans seemed few, poor and miserable. The probable

The priests and nobles all died or were killed.
People's knowledge of the ancient culture died too.

reason is that they had been having terrific intertribal wars. Survivors of a losing side hid in their underground storerooms, hoping to avoid being roasted for a victory dinner.

In the early nineteenth century, foreign pressure on the Pascuans rose. American whalers stopped to kidnap natives for slaves or to shoot a few for target practice. Hence the Pascuans became increasingly hostile to strangers, and their hostility caused more clashes. A group of French missionaries who landed in 1843 were massacred.

The Pascuans presented a formidable sight. Like other Polynesians, they were a tall, powerful, heavily-built folk, the men being notably taller than the women. Many went entirely naked, although some men wore a G-string and many women a grass skirt, and all donned bark-cloth cloaks against the chill winds.

The men were bearded, tied up their hair in topknots, and wore large wooden plugs in their ear lobes. They tattooed themselves all over, and the men were painted over the tattooing in gaudy patterns of red and black. When a visitor arrived, they crowded down the beach, capering, dancing, and yelling. Many would be friendly, but others at the least provocation would throw stones with alarming accuracy.

Rapa Nui's culture received its fatal blow in 1862. One day, Peruvian ships anchored off the island, attacked the islanders, killed some, and rounded up about a thousand others, whom they carried off as slaves. After Bishop Jaussen of Tahiti protested, the Peruvian government ordered the victims returned. By this time nine tenths of them had perished. Of the remaining hundred, all but fifteen died of smallpox on their way home, and the survivors spread the disease among those who had remained on the island. So the population shrank from several thousand to a few hundred.

The dead included King Kamakoi and nearly all the priests and nobles. Since these were the people who had kept the records and knew the procedures, the culture fell to pieces. Then Catholic missionaries landed and took up their work, made easier by the disappearance of the native leaders and the decay of traditions.

The modern ideal of benevolence towards the backward, however, at length made its way to Chile. Today, although poor by western standards and bereft of most of their ancient culture, the Pascuans seem healthy and fairly happy. In 1955 the population was 842.

The Pascuans were much more than just a cannibal tribe. Despite their isolation, they developed a complex culture. They carved pictures on rocks, engaged in sports like surfboard riding, and observed complicated religious ceremonials.

They also had a system of writing, unique among Polynesians. They incised lines of characters on wooden boards. A special class of reciters, called *tangata rongorongo*, kept the boards and read them.

With the destruction of the ruling class in 1862, this system of writing was practically forgotten. By the 1870s, when scholars began to take an interest in their writing, the Pascuans were using the last of their tablets for firewood or for building canoes. They said the missionaries had urged them to burn the tablets as relics of paganism.

Many efforts have been made since then to decipher Pascuan writing, and some quite fantastic theories have been advanced. One such cryptographer was Bishop Jaussen, who tried to rescue the Pascuans from Peruvian slavery.

In the 1950s a German scholar, Thomas Barthel, after a world-wide search, found Bishop Jaussen's linguistic notes in an Italian monastery. He also rounded up copies of the two dozen surviving rongorongo boards, scattered in museums around the world. He claimed to have deciphered the writing, which he said consisted of hymns and other ritualistic material. More recently, Russian and Norwegian scholars have denied Barthel's claims. So the problem of the rongorongo boards has not yet been settled—if, indeed, it ever will be.

The most spectacular Pascuan achievement was the famous statues. The Pascuans built sacred inclosures called *ahu*—rectangular, pyramidal, or ship-shaped—as burial platforms. Some ahu were as much as 300 feet long. Around each plat-

The statues of Easter Island are not just heads or busts, but the heads are usually so large in proportion to the squat bodies that the bodies are forgotten. Most of the statues were overturned during fierce intertribal wars that in 1800s plagued the island.

KFS

form they erected statues, facing inward. When a Pascuan died, his kin wrapped his body in bark cloth and placed it on a scaffold on the ahu, where it remained for months before being buried. There were once about 260 ahu, with a varying number of statues—up to sixteen—apiece. Many ahu were demolished for their stone.

The Pascuan ahu and their statue were used also for religious rites; Roggeveen saw the natives squatting around fires in front of the statues and going through the motions of praying. Possibly they thought the spirits of their ancestors entered the statues during these rites, but of this we cannot be sure.

Competition for prestige led each chief to build bigger and bigger statues. In many parts of Polynesia, chiefs used megalithic building as a way to gain honor. Thus Tonga acquired its famous trilithon, consisting of two uprights of coral rock weighing thirty-odd tons each, supporting a lintel of the same material. Other Polynesian peoples also built sacred inclosures and carved gigantic statues of wood or stone.

The Pascuan statues were made of volcanic tufa from one quarry in the crater of Rano Raraku. Everything about them indicates that they were made, not by men of some vanished Lemuria nor yet by Peruvian explorers, but by the ancestors of the present Pascuans. While there is no exact way to date individual statues, the custom of erecting them probably lasted down to the eighteenth or early nineteenth century.

Aside from nearly 200 unfinished statues in the quarry and a few scattered along the roads leading thence to the coast, the statues fall into two groups. One comprises the ahu statues, which were sledded from the quarry by grass ropes. They were then erected by prying up one end, shoving stones under it, prying it up a little more, and so on until it lay at a slant against a heap of stones. The final erection was done with ropes. The ahu statues were also given cylindrical "hats" of red volcanic rock from another crater, representing the Pascuan man's topknot.

Carved without eyes

Another group, between 250 and 300, were erected on the slopes of Rano Raraku. These statues lacked topknots. Instead of having flat bases for standing on the pavement of an ahu, they end in tapering stone pegs, driven into the soft volcanic soil to support the statue.

Their carving also differs from that of the ahu statues, suggesting that they were made at a different period. Whereas the ahu statues have the orbits of the eyes sculptured all the way round, the volcano statues have no distinct eyes. The planes of the cheeks are carried right up to the eyebrow ridges, whose shadows look like eyes.

One theory is that the volcano statues are unfinished ahu statues. They were erected, it is said, on the slopes of Rano Raraku to finish the carving on their backs. Then they

were hauled to their sites, where their pegs were cut off so that they could stand on their ahu. Lastly, the carving around the eyes was completed so that the statue could see.

During the intertribal wars from 1722 to 1840, all the ahu statues (save one, badly weathered and partly buried) were overturned. Along with burning their houses and destroying their exposed corpses, each tribe upset the statues of its foes to insult them. Now every ahu statue lies flat on the ruins of its platform, save the weathered one and one other re-erected in 1956.

The volcano statues, however, were not vandalized. Although many have been upset and buried by landslides, more than half still stand, frowning forever across the rolling land and the pounding sea. Whether the volcano statues were made before, after, or at the same time as the ahu statues; why they were set up on Rano Raraku; why they were not toppled with the rest; when and why the Pascuans stopped making statues—these questions may never be answered.

One may wonder why the Pascuans went about everything so frantically, whether erecting colossal statues, welcoming visitors, or butchering and devouring one another in relentless wars. Perhaps the boredom of utter isolation is the answer. Having settled on an almost treeless island, they could not leave because there was no timber for shipbuilding.

The isle gave its people a good living—at least until they became too numerous—but no variety. There were only the grassy fields and volcanic knolls, and beyond them the booming sea. There were no wild beasts to hunt or be hunted by; no neighboring tribes to fight or trade with; no other lands they could reach in their flimsy little canoes, patched together from driftwood; no traders to stop by with trinkets and news.

So, to relieve the tedium, they went in for games and sports, for fantastic rites and ceremonies, for bizarre forms of personal adornment, for megalithic construction projects, and finally warfare.

"Don't get psychedelic with me, Morris Weldon."

The most snake-bitten man in the world

Venom taken from 600,000 poisonous snakes by W. E. Haast is used in medical research, including cancer, and to make venom antitoxin.

by William and Ellen Hartley

SHORTLY after 8:00 PM on March 9, 1967, the phone rang in the office of William E. Haast, director of the Miami (Florida) Serpentarium. Although best known to the public as a tourist attraction, the Serpentarium is a serious scientific institution, and the largest private

production center of snake venom in the world.

The caller was Dr. Eduardo F. Pena, a Miami physician. He had just learned from a Miami ham radio operator, Jerry Martin, that a child of five was dying in a mission hospital near Barquesimito, Venezuela, after being bitten by a deadly coral snake. Could Mr. Haast do anything to help?

It so happens that Bill Haast, a quiet, modest, intense 56-year-old scientist, has (at this writing) survived 101 bites from the world's most venemous snakes. He has been hit by the Indian blue krait, coral snakes, the green mamba, cobras, even the King Cobra. He could almost be called a living laboratory of snake venom antitoxin. The National Institutes of Health at Bethesda, Md., has processed serum from his blood. Some was on hand at the Miami Serpentarium when Dr. Pena called.

Bill's wife, Clarita, set about packaging the serum. An airman drove up from Homestead to rush Haast to Homestead Air Force Base where a special jet dispatched from Washington was being warmed up for the flight to Venezuela. His presence in Venezuela was imperative, since he probably knows more about the effects of snake bite than any other man on earth. When Haast arrived at the mission hospital at Barquesimito, he found that the boy, little Francisco Jose Piña, was gasping and close to death. The resident doctor, a woman, had administered the only available antivenin—a product made for rattlesnake bites. But rattlesnake poison is hemotoxic (affecting the blood) while coral snake bites are neurotoxic (attacking the nerves.)

Haast's serum was passed intraveneously into the bloodstream, and the child began to improve. Three hours later, seconds after the helicopter had left the ground, the crew noticed excited waving from the hospital and landed again. The child was in a coma.

This time the serum was administered intramuscularly. Within an hour the child had recovered sufficiently to smile at the North American stranger who had given him back his life.

Venom pain-relievers

The production of antivenin (also known as anti-toxin or anti-snakebite serum) for snakebite victims is just one of the life-saving uses of venom provided by Haast's organization. Actual medications are made from snake venoms. Two of the best known are Cobroxin, for intractable pain, and Nyloxin, for relief of pain in arthritis.

There have been many studies of cobra venom as an agent for controlling intractable pain, such as in terminal cancer. As early as 1938, D. I. Macht successfully produced sterile solutions of cobra venom, and standardized dosages. Since he used mice for standardization, a dosage unit is called a "mouse unit". (The amount of venom that will kill a 20-gram mouse in 24 hours.)

Bill Haast knows more about snake bites than any one in world. His blood is used in antitoxin serum.

In 1952, Drs. Ralph G. Hills and Warfield M. Firor of Baltimore, Md., reported in *The American Surgeon* on their five-year study of the use of cobra venom to control pain. They had treated 30 cases, including three patients with severe migraine headaches, and noted, "the results have been gratifying".

In one interesting case, quoted here almost word for word, a 70-year-old man was hospitalized for a leg amputation. Later, he had severe pain. "For two months he received morphine and demerol regularly without any decrease in the pain," Hills and Firor reported. "Cobra venom in a dosage of 50 mouse units daily was given for three weeks. By the twentieth day the morphine had been entirely eliminated. The cobra venom was diminished to 50 mouse units twice a week and this has sufficed to control his pain."

It should be emphasized that cobra venom is *not* a cure for cancer, arthritis or migraine. What it does, in some cases, is to reduce pain. As the manufacurers of Cobroxin note, its outstanding advantage is that it is not habit forming (as in the case of morphine) and doesn't produce the undesirable side effects associated with the opiates.

Nyloxin, used for arthritis, has been widely tested and found to be quite effective. One study, conducted over a five-year period, showed that pain was relieved in 80 percent of 466 cases. Some individuals show allergic reactions, but these can be controlled by reducing dosage.

A curious aspect of the venom medications is that they have a cumulative effect. With Cobraxin, for example, a fairly long series of injections are required before a drug becomes effective. Then dosage may be reduced. (These are not products obtained without prescription.)

No one knows exactly where snake venom research is going to take us, but the possibilities are tremendous.

There is a disease *(amyotrophic lateral sclerosis)* that causes weakness and progressive atrophy of the muscles. It's a slow killer, the victims usually dying within two or three years.

But neurotoxids produced from snake venom have shown promise of slowing down the disease. Reporting in 1960, Dr. Murray Sanders, University of Miami (Florida), stated that of four patients with the disease who were considered terminal cases at the time of treatment three were alive six years after therapy with the snake extract began.

The neurotoxoid has also been effective with *herpes simplex* (fever blisters, cold sores) and *herpes opthalmicus*, an eye disease.

One fascinating study is the use

Bill Haast's wife, Clarita, helps in the force feeding of a King Cobra after its venom has been taken from it by Haast seizing the reptile behind the head and inducing the cobra to strike at a membrane stretched across a glass vial. The venom drips into the vial which later is taken to the Serpentarium laboratory for processing and storage.

of a nonpoisonous extract from cobra venom to prolong the survival of transplanted organs, and to prevent a rejection shock in the animal given the transplant.

For years, medical scientists have dreamed of the day when kidneys or other organs could be transplanted from animals or dead persons into living diseased individuals. If parts of bodies were thus interchangeable, like automobile parts, countless lives could be saved.

The trouble is that our bodies have a natural tendency to reject "foreign" organs or elements. When this mechanism functions, the result is "anaphlactic shock". If a graft or transplant is major, the shock usually causes death. We've used certain drugs to prolong the life of tissue grafts, but they tend to cause infections while suppressing the body's natural resistance to the new tissue.

Dr. Gilbert B. Snyder and associates at the University of Miami Medical School have been using detoxified cobra venom to prolong the survival and function of transplanted kidneys in animals. When these researchers placed pig kidneys in the necks of dogs and hitched up the dog's circulatory system, the transplants lasted for an average of only 9.5 minutes. But when they injected the venom element 18 hours before the transplant, grafts operated for an average of 133 minutes, and some lasted for 24 hours.

What happens, apparently, is that the venom checks the production of antibodies in the host animal. There is no human application at present, but Dr. Snyder has observed that the studies open up "a new avenue

for organ-transplant research". They may also lead to new treatments for certain kinds of arthritis, heart disease, thyroid conditions, progressive skin diseases, etc.

Venom from the Russell's viper (India) contains an agent that controls bleeding. This venom is also being used in blood tests to study coagulation rates. Scientists at the Howard Hughes Medical Institute are deeply interested in some complex aspects of snake venom. So is the National Institutes of Health.

Snake venom for cancer?

In fact, there are literally dozens of medical schools and independent research laboratories now using venom products in studies of cancer, (venom of the Indian blue krait has been found to dissolve the coating of the leukemia virus), heart disease, and many other ailments. Since most scientists want venom from snakes not native to America. William Haast's supply has grown increasingly important.

Haast does not "milk" snakes, a process common in foreign countries. This procedure damages the venom glands and kills the snakes. Haast's procedure, known to the thousands of tourists who have watched him at the Miami Serpentarium, is to remove a snake from its cage, control it manually by seizing it behind the head, and induce it to strike at a membrane stretched across the top of a glass vial. The venom drips into the vial and is later taken to the laboratory for processing and storage under sterile conditions. Snakes, currently numbering about 700 in Haast's collection, are force-fed following the extraction.

Clarita Haast stands by while her husband performs the extractions, and describes what's going on to the visitors. On many occasions, she has seen him accidentally bitten, then watched in horror while he continued with extractions and later calmly recorded his mounting symptoms of poisoning. Several times, she has paced hospital corridors while he fought for his life in an iron lung.

This extraction procedure is the main reason why Haast has been bitten 101 times while handling an estimated 630,000 snakes of almost every known variety. He has also immunized himself partially by injecting his own body with small amounts of venom. Serum from his blood is thus valuable in treating a wide variety of snakebites.

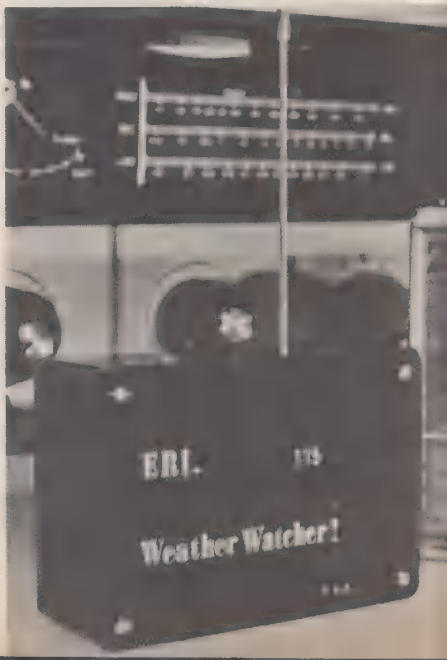
Recently he requested and received a charter from Florida for a non-profit organization, and he now plans to establish a study project involving the "Environmental Control of Venomous Snakes of the World". This program is important because of the increasing demand for exotic venoms, the limited supply of foreign snakes in America, and our incomplete knowledge of the care and breeding of snakes in captivity. In the event of a cancer cure, for example, that depends on cobra venom, we should be assured of an adequate domestic supply.

NEW FOR PEOPLE

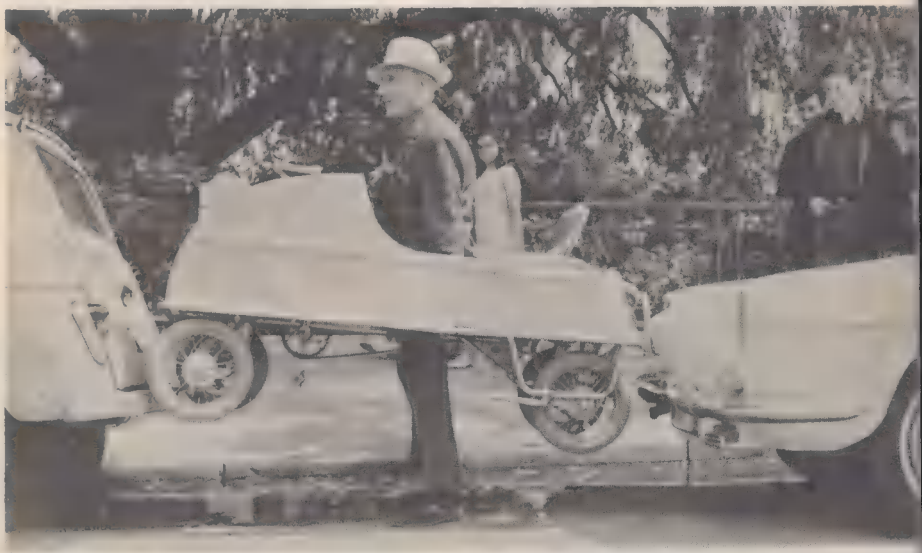
Oil will supply power for every utility needed—lights, power, heating and cooling—in Humble Oil & Refining Company's new $1.5 million service station complex to be built on the Pennsylvania Turnpike about 60 miles west of Harrisburg. The total energy concept service plaza is expected to be in full operation by next August.

The Cara Cardiac Press, product of Macarthys' Ltd., England, mechanically stimulates the heart. The plunger is placed over the heart and pumped at the rate of 60 strokes per minute. Pauses are made every 10 to 15 seconds to allow the lungs to be artificially inflated since artificial respiration is administered simultaneously.

VHF-to-Broadcast signal converter, product of Executive Research, Inc., is a "Weather Watcher" that receives the round-the-clock U. S. Weather Bureau forecasts on 162.55 MHz and converts them to play through a nearby AM radio, battery-or AC-powered. The kit is $14.95. Finished set $18.95.



New Betalights self-contained light source needs no external power when a panel, instrument or control requires illumination and is in inaccessible locations. A Canrad Precision Industries, Inc. product, Betalights last 20 years without replacement.



Mini-cars to match mini-skirts are the latest in automobiles in France. The atokart is available for about 100,000 old francs. The inventor, 75-year-old Ruiz Luciarte, demonstrates the size of the atokart compared to other automobiles.

The new Tessina 35mm shockproof camera takes less space than a package of cigarettes, weighs seven ounces but uses standard 35mm film suitable for blow-ups to 20" X 24" or bigger. Provides focusing from infinity to ultra close-ups at 9 inches.

The 10

by Edward Edelson

EXHAUSTED from fleeing the pursuing hound, the deer stumbled into the clearing and caught sight of a group of hogs being driven to the barnyard. For a while the deer stood motionless. The he slipped into the center of the group and walked with them, slipping back into the woods when the hogs neared the barnyard. When the hound sprinted out of the woods he had lost the deer's trail and began chasing the hogs.

The deer clearly acted with intelligence—or did it? Faced with that question, most ethologists—scientists studying animal behavior

K.F.S.

Baboon

An ill tempered beast, but a smart one.

K.F.S.

Dolphin

The chimp's most serious challenger.

smartest animals

—would prefer to avoid a direct answer, and even to avoid using the word "intelligence". In fact, they'd even steer clear of using "instinct" as an explanation.

The concept of animal intelligence now is generally regarded as too anthropomorphic, while instinct seems too fuzzy a term. Ethologists today tend to talk about "the ability to adapt to new situations" versus "genetic programming". But no matter what terms are used, the idea that animals can act with some degree of intelligence is never far below the surface.

"Just as we are genetically related to animals, our mental processes are probably quite similar," says Dr. Donald R. Griffin, director of the Institute for Research in Animal Behavior. "But there is very little hard, firm fact to go on."

Today's investigators are likely to question many established principles of past years. They are even questioning what might be the most widely accepted belief in the field—the ranking of the chimpanzee as the most intelligent animal.

Not that scientists doubt the chimp's m e n t a l powers. Several chimps, raised in private homes, have been able to keep ahead of young children in learning, up to the time the children began to talk. After that the humans pulled ahead quickly.

K.F.S.

Elephant

Opinions vary, some describe them as very smart, others as rather silly animals.

But the classic experiments of Wolfgang Köhler have shown that a chimp occasionally can act with more insight than a human. Given a stick and a banana hanging out of reach, the chimp would put the stick in place and climb it to retrieve the banana. Some people would swat at the banana, smashing it to a pulp.

Acknowledging the chimp's ability, scientists point out that much less work has been done with other primates that might be contenders to the throne, because those primates are not as easy to handle. The baboon, for example, is an ill-tempered beast, yet there is ample evidence in folk-lore of its intelligence. Some Africans even believe the baboon can talk. A story is told of a baboon that kidnapped a baby and took it to the top of a tree, releasing it only when a Bushman literally talked him into it.

The chimp's most serious challenger may be the dolphin, whose brain actually weighs more than a human's. While stories of the dolphin's intelligence date back at least 2,000 years (the Romans told of a dolphin that befriended a young boy, gave him rides daily and wasted away after the boy's death), the work of John C. Lilly and other ethologists has raised the possibility that the dolphin may potentially be as intelligent as humans. Lilly now is trying to decipher what he believes to be the dolphin's lan-

guage, and to teach them to communicate with humans.

Barring Lilly's success, comparing the dolphin's abilities with the chimp's may forever be impossible. Scientists will accept only the results of carefully controlled experiments, and there are obvious difficulties in preparing tests that would allow comparisons between two such different animals. The same difficulty hinders all similar efforts. Is the ability to run a maze, for instance, equivalent to the ability to pick the odd object from a group of three?

There's a more subtle pitfall: The unconscious tendency to treat animals in the lab as slightly different kinds of humans, rather than acknowledging their widely varying natures. People get most of their sensory input through vision, and scientists have tended to lean heavily on tests involving visual cues. This works against animals that get most of their information about the world through smell or hearing.

One way out of the difficulty is to measure brain weight—or rather, the ratio of brain weight to body weight. The great whales have the largest brains of all, but they must control vast bodies weighing more than 100 tons, which means that relatively few brain cells are left over for what we would call reasoning behavior. The dolphin's brain, weighing nearly four pounds, con-

U.P.I.

Rat

Crafty enough to survive in man's world.

K.F.S.

Chimp

When young they learn faster than a man.

K.F.S.

Crow

Knows how to stay out of gun range.

U.P.I.

K.F.S.

Coyote

Neither of these creatures is well liked, but their intelligence has earned respect.

Wolverine

Audubon Society Photo by Leonard Lee Rue

trols a body weighing 300 pounds, a far more favorable ratio.

Judging the elephant on that standard is difficult. Its brain weighs four times as much as a human's, but its body weighs 46 times as much. There are widely differing opinions about the elephant's intelligence. Some call Jumbo one of the most intelligent animals. J. H. "Elephant Bill" Williams, once heard an elephant keeper tell his charge to hand up a spear. The elephant picked the spear up in its trunk and presented it point first. "Turn it around" the keeper said—and the elephant did.

But Richard Carrington, a keen student of elephants, wrote that "it is doubtful that the mental powers of the elephant are very much greater than those of the horse. And the horse, as those of us who are not sentimentalists will probably admit, is naturally a rather silly creature."

One thing ethologists do agree on is that mammals have a virtual monopoly on animal intelligence—with perhaps a few grudging exceptions. Using tools can be regarded as a sign of intelligence, and the Galapagos woodpecker-finch uses a cactus spine to root insects out of holes and crevices. Most observers would also give fairly high marks to the crow and his relatives. Crows' ability to stay just out of range of a hunter's gun is well-known, and scientists are beginning to acknowledge that there might be more than "genetic programming" in the ability of jackdaws and parrots to learn some human words.

Problem-solving is not the only indication of intelligence. The sheer playfulness of otters is one reason why they are listed among the most intelligent animals. Otters will carefully prepare slides of snow or mud and frolic on them for hours, apparently following complex rules in some of their games. One observer in India saw six otters hunting together in a circle. As each caught a fish, he would put it on the bank and return to the circle. In the United States, trainer Emil E. Liers has taught his tame otters to retrieve game birds.

Escape to sea

The sea otter might be even more remarkable. At one time it lived partly on land, but escaped the hunters that once almost wiped it out by learning to live entirely at sea. The sea otter also uses tools. While floating on its back it will place a flat rock on its belly. Then it will smash shellfish open against the rock.

Survival under pressure often is a test of intelligence. The coyote's ability to flourish despite determined drives against it has earned it bitter respect from its hunters. Coyotes can work in teams to exhaust hounds in the chase, and they have been known to jump on railroad trains or cars to escape pursuit. Eating almost anything—and often stealing its food from smaller predators—the coyote has been called "the smartest varmint alive".

On the criterion of survival, the rat must rank high in view of the eternal war waged against it by man. The rat's quick-breeding habits are important in its survival, but cunning appears to play a major role. Some experienced rats have been known to kick a trap around until it went off, then eat the bait. Caged rats, offered a large dog biscuit that could not fit between the bars horizontally, have reached out, turned the biscuit to a vertical position without hesitation and pulled it in to eat.

One animal whose sheer malevolence has earned it a reputation for intelligence is the wolverine. This 30-pound carnivore can literally put a trapper out of business, carrying off his traps, destroying the catch and even invading the trapper's cabin for a vicious carnival of destruction. Awed trappers credit it with an almost human insight into the workings of mechanical devices, and there are few traps that the wolverine cannot spring after only a short acquaintance.

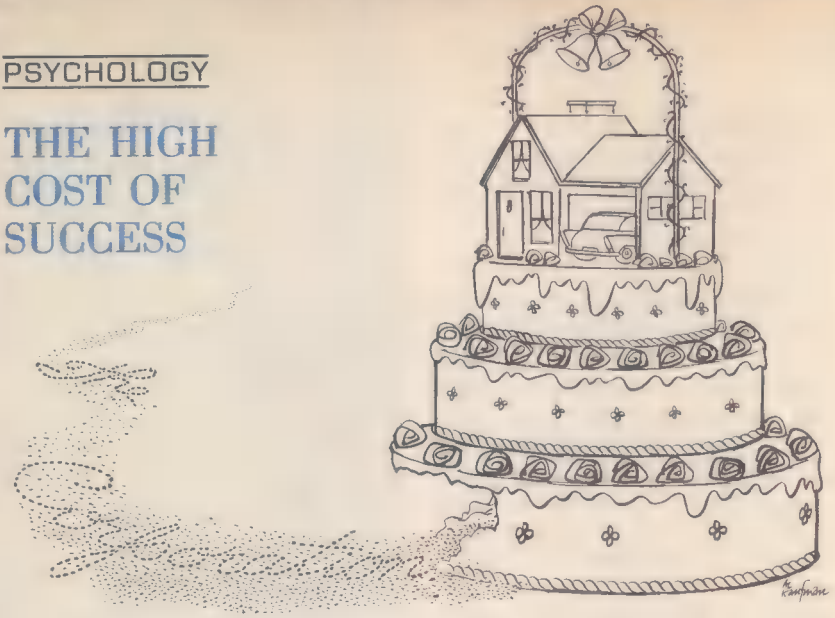
The raccoon has a similar ability, but it is fortunately a more friendly animal.

The ultimate answer to the questions of animal intelligence, many ethologists believe, lies in using field observations to sharpen laboratory techniques.

As scientists learn more about the way animals behave under normal conditions, they will be able to prepare better laboratory tests. And out of those tests may come some more definitive IQ ratings for man's animal cousins.

PSYCHOLOGY

THE HIGH COST OF SUCCESS



Rising young executives in U. S. corporations find their roads paved with frequent transfers, exhaustive days, too much travel and marital problems.

by John Barnett

THE corporation is taking the place of the Other Woman in the so-called eternal triangle—and the staggering impact on executive marriages suggests that big business is the most demanding mistress of all.

According to psychologists, physicians, family counselors and others, companies now absorb too much of the time, energy and devotion of their rising young executives; exhausted by their jobs, they are mere shells at home, unable to function effectively as husbands and fathers.

The result is seldom divorce, which is bad for the careers of young men on the go. Instead, marriages in name only are preserved between weary, indifferent men and women beset by all sorts of emotional ills, including chronic loneliness, sexual frustration, alcoholism and excessive dependence on their children.

It would be difficult to overestimate the sweep of such problems, many sources agree. "They are almost epidemic in proportion," says Mortimer R. Feinberg, professor of psychology at City University of New York's Baruch School of Business and president of BFS Psychological Associates, a personnel consulting firm in New York.

Some companies realize what is happening. "We're ruining a lot of families," confesses the top medical officer of a big Pittsburgh firm. The

staff psychiatrist for one of the nation's largest manufacturers concurs, saying: "The situation is really rough, and it's getting worse."

But few, if any, firms do anything to combat it. "As far as I can tell, there isn't any company in the nation that's really touching this problem," says psychologist Harry Levinson, director of the division of industrial mental health at the Menninger Foundation, Topeka, Kan.

According to independent counselors, many firms are fatalistic, believing that such troubles are an unavoidable consequence of the pressures of management and personal ambition and in any case, are private matters not to be meddled with. Other firms doubt that much trouble exists or profess to be unaware of it. Many of the nation's corporate giants won't even discuss the subject.

But private counselors and agencies have enough data to know that the problem is growing. In Glen Ellyn, Ill., a Chicago suburb heavily populated by executive families, the Family Service Association of DuPage County reports a marked rise in the past 10 years in alcoholism, marital infidelity and even childbeating—with strong evidence pointing to business pressures as a major contributing factor.

In some New York suburbs, counselors tell of families composed of emotionally disturbed or delinquent children, bitterly frustrated wives and husbands so neglectful they do not even realize what is happening to their home lives. The president of one New York firm, for example, was home only every other weekend and usually spent that on the golf course or in the country club steam room. Only after one of his teenaged children attempted suicide did he discover that his wife was becoming a tippler and that another child was taking narcotics.

Many executives and their wives, of course, manage to lead full, happy lives despite the pressures of work, often because they live within a self-imposed set of rules.

Family counselors and psychologists agree that most emotionally healthy people can successfully accommodate to the demands of business. But they also agree that these demands can be devastating to a marriage if emotional flaws are present—when, for example, a wife has a general feeling of insecurity or inadequacy to begin with, and her husband tends to avoid taking a part in solving family problems. And these, they note, are not uncommon faults.

What is more, the demands of the executive suite have increased relentlessly in recent years, subjecting marriages to pressures many simply cannot resist. Executive recruiters and corporate officials can't find enough good young executives to fill all the posts open to them; Gerard L. Phillippe, chairman of GE, calls the search for executive manpower U.S. industry's "greatest challenge". In the meantime, the shortage has led many companies to squeeze an unprecedented amount

of mileage out of their staffs.

Paradoxically, the jet age has increased the time spent away from home by many executives, instead of reducing it. A strictly informal poll reveals that the average executive is apt to spend some 30 percent of his work week on the road. If he is in sales, the percentage may be far higher.

Thwarted sex life

Psychologists and family counselors agree that many wives express their resentment and bitterness against frequently absent husbands by denying them sexual relations—even though the wives often are starved for sex themselves. Inevitably, some of these lonely women turn to promiscuity, others to the bottle.

Still others turn to their children, smothering them with a cloying, unnatural affection, overprotecting them or demanding entirely too much of them. "We have kids who are confused, immature, burdened by their mother's confidences, troubled by the changes in roles, with their fathers gone and their mothers imposing the discipline. These women are feeding on their kids for the emotional support they should be getting from their husbands," says one family service caseworker.

It is difficult to tell when the first signs of a marriage's erosion begin to appear. In the early years, there is generally little difficulty; wives share their husbands' eagerness to get ahead and are understanding of the demands placed upon them by business. But as the years pass, husband often begins to grow away from wife.

After a while, in many cases, the husband is so driven by his job that he begins to view his home primarily as a place to come and rest, a haven from the relentless pressure exerted by his job. His wife, of course, needs his partnership, but he is often too weary to give it. She grows bitter and nags him; he grows resentful because he feels she is selfishly ignoring his needs.

Robert Sunley, a Mineola, N.Y., marriage counselor, tells of a typical case: George M., an $18,000-a-year sales executive for a New York machine maker. The Ms live in a comfortable home, have three children, two cars—and a bitterly unhappy marriage.

Plans go awry

As a young couple, they looked forward to the day when business success would bring them both the time and money to fully enjoy each other's company, and they accepted the demands of his job in order to reap future rewards. But Mr. M's hours got longer instead of shorter, and he became more and more involved in his work and less and less interested in his family. Now, when he is home, the Ms battle constantly—about money (there is never enough), the upbringing of their children, the general lack of

Corporation "widow" subjected to loneliness and neglect strikes back with bitter reprisals

tranquility in their household.

Between arguments, there are long periods of silence—a week or more, sometimes, in which they do not speak to one another. They commonly go a month or two without sexual contact. Mr. Sunley's diagnosis: Mrs. M is suffering from deep-rooted sexual dissatisfaction, and her husband is suffering mainly from sheer exhaustion, from long hours and worry about his job.

Even the sense of belonging that can come with living in the same community for a reasonable length of time is denied many women by increasingly frequent corporate transfers. It's not uncommon for an executive to move five times or more before settling in at headquarters; Allied Van Lines says it has a number of corporate family customers it has moved 10 times or more.

"We constantly see the wife who simply has moved once too often," says Henry Freeman, executive director of the Family and Children's Service of Pittsburgh. "She's finally become exhausted from battering down the walls in each community she comes to. She gets depressed, lets everything go, withdraws, worries the hell out of her husband."

Even those wives fortunate enough not to have to take many transfers have difficulties. As their husbands rise in income and status, often there are subtle pressures on these women to abandon their old activities and circles of friends and step into "higher" society. This amounts to a "social transfer" that can be as difficult as a physical one.

The mobility of the executive class has served to undermine a major stabilizing factor in many marriages—the comforting presence of relatives, who provide not only social contacts but emotional outlets, too. Far from home, today's executives and their wives often must rely on each other almost entirely. "They have all their emotional eggs in one basket—the marriage," says Mr. Freeman.

Thus, when the marriage begins to go sour, the husband often can only bury himself still deeper in his work, and his wife can only grow more bitter and more resentful. In the case of young executives, this may go on for years; according to the rules of the corporate game, divorce is frowned on.

All the blame for increasing marital difficulties among executives cannot be placed on the corporation alone, of course; the driving ambition of the individuals themselves naturally plays a part in the troubles they have at home. But the company's demands on the man who does want to go places are heavy, and unfortunately only few concerns are recognizing this and beginning to take halting steps toward easing marital problems.

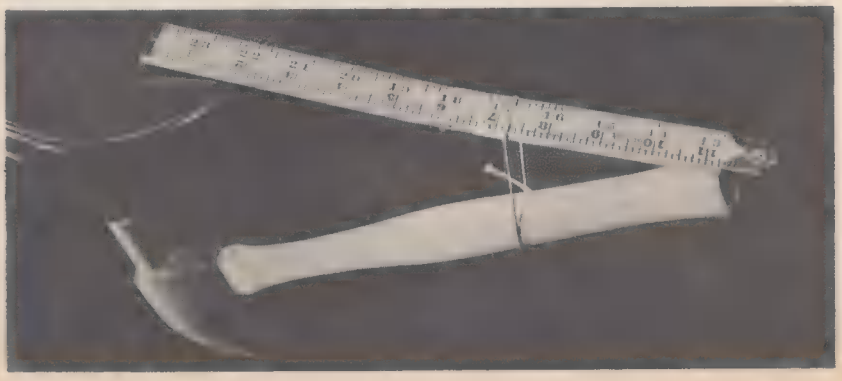
Six impossible tricks

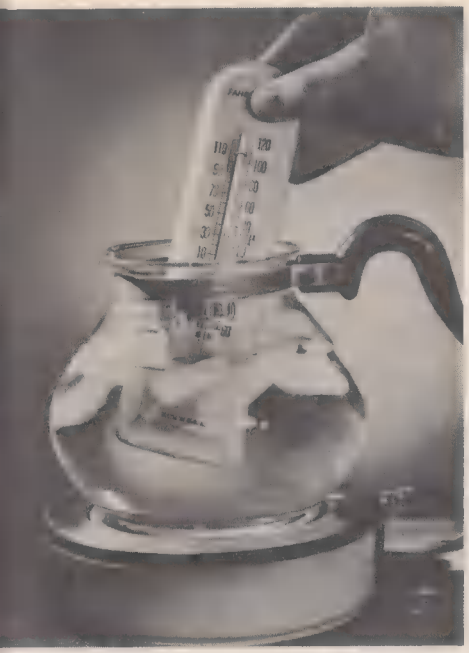
DEMONSTRATIONS of an obvious defiance of Sir Isaac Newton's law of gravity show how a marble will dance in an inverted funnel spout; that a square of metal or screen, heavier than water, will float on water with a large cork on it. Again, there is a way to balance the edge of a carpenter's folding rule on a table edge by using a hammer and a piece of string.

Place marble in an inverted funnel, its stem connected by a hose to a water tap. Turn the water tap on full pressure and watch marble dance close to funnel spout, defying gravity. Pressure inside water is less than that pressing against marble.

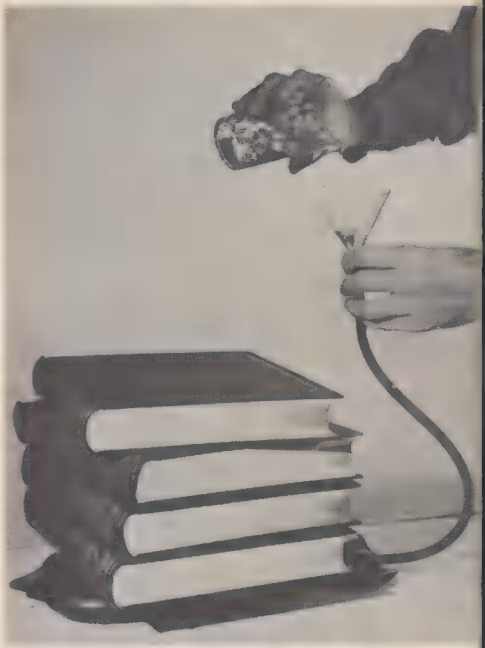
Steel screen is heavier than water but a small square of it will float if it is wiped lightly with cloth and wet with salad or machine oil. Lay carefully on surface of clean water in a dish. Large cork put atop material will not sink it.

Hammer balances edge of carpenter's two-foot folding rule on table edge as loop of string causes hammer to act as lever that pushes up on the end of the rule. The heavy hammer head places the center of gravity surprisingly beneath table.





Stir ice and water in bottom section of glass coffee pot until water reaches 32° F., freezing point. Then put the pot over heat and stir water constantly with a thermometer. As long as any ice remains in pot, water will hold at freezing point.



Place 15-20 pounds of books on syringe-type hot water bottle. Run water into bottle through the syringe held upright. Water pressure at lower end of hose flows equally to equal areas inside bottle. The resultant pressure lifts the heavy books.

When dropped from end holding coin, ruler falls faster than coin. Drop both ends of ruler at same time and objects fall at equal speed. Why? Dropped by end, ruler acts as pendulum with distributed weight. Point two-thirds from held end falls with acceleration of speed. And beyond the two-thirds point, the ruler will fall faster.

Science Month

Photograph exploding stars

White line in picture of galaxy points to supernovae similar to one photographed 600 million light years from the earth by 48-inch schmidt telescope (pictured immediately above) at Mt. Wilson and Palomar Observatories in California. In the past 1000 years five possible supernovae have been recorded in our Milky Way.

Two supernovae or exploding stars—one in a spiral galaxy 30 million light years from earth, the other in a galaxy 600 million light years distant—were photographed last July through the 48-inch schmidt telescope at the Mt. Wilson and Palomar observatories in California. Their light is reaching the earth only now after traveling through space at the speed of 186,000 miles a second.

Each of the supernovae, also known as gas clouds, increased in brightness from about that of the earth's sun to the equivalent of two billion such suns but, even with this brightness, they are too far away for observation without powerful telescopes.

The two explosions were discovered by Dr. Fritz Zwicky of the Mt. Wilson and Palomar Observatories, operated by the California Institute of Technology and the Carnegie Institution of Washington, D.C. Dr. Zwicky explained that supernovae are essentially catastrophic events probably resulting from the collapse or implosion of a star or gas cloud.

Astronomers are especially interested in supernovae because studying them contributes to a better understanding of the evolution of matter. Supernovae also have a potential use as distance indicators. If their intrinsic brightness is determinable, they can be developed into

a yardstick to measure great distances in their universes.

Supernovae occur on the average of once every 300 years in brighter galaxies, although three galaxies have had three within 40 years. In the past 1000 years five possible supernovae have been recorded in our Milky Way Galaxy.

A supernova will remain at its peak brightness for only a few days before gradually dimming, with the slow decline lasting for several months.

Duck — here comes Icarus!

Icarus, an asteroid one mile in diameter, is one of several hunks of cold matter (possibly iron) that whirl in elongated orbits around the sun. Occasionally, they pass near the earth. If Icarus ever hit us the result would be catastrophic. Next year, the asteroid will come within 4,000,000 miles of earth on June 15 and, just for kicks, students at Massachusetts Institute of Technology have figured a way to save the world should it veer off course and collide with us. For the study, the students assume that Icarus will hit the mid-Atlantic 2000 miles east of Florida at 12:26 GMT on the 19th. Such an impact would splash 1000 cubic miles of water from the sea, make a 15-mile-wide crater in the ocean floor, raise tidal waves 100 feet high that would wipe out New York, Boston and most other port cities on both sides. Energy released would equal 500 billion tons of TNT, and would shake things up 100 times worse than the most violent earthquake ever recorded.

Starting now, the fight would involve a mad race with time. Nine Saturn V moon rockets would be needed; three for test, six for mission—each armed with a 100-megaton nuclear warhead. First launch would be April 7, 1968 when Icarus was still 100 million miles off. It would close with the asteroid on June 6. By then, three more would be on the way. Final shot would launch on the 14th, intercepting the intruder a scant 18 hours before it was due in. The entire elaborate plan, including radar and OAO star trackers and computers would keep track of everything. On-board computers would maneuver the rockets to within 100 feet of the screaming menace and trigger detonation. If fragments still menaced earth, later launches would be detoured by radio in hot pursuit.

But don't worry. It isn't likely to happen.

Ice-age pigs unearthed

Ice-age fossils of four peccaries—pig-like animals between 25,000 and 40,000 years old—have been unearthed in an excavation near Hickman, Missouri. Warren Finch, of the U. S. Geological Survey, calls the discovery, "One of the most important fossil finds in this part of the country."

The fossil bones are of animals

Ice-age pig-like animal reconstructed by Smithsonian Institution. These peccaries roamed earth 25,000-40,000 years ago.

measuring about three feet long. They roamed the area during the ice age. The bones were carefully uncovered, the exposed parts shellacked and covered with plaster and then removed from the still imbedded dirt, and shipped to the U. S. Geological Survey's offices at the Smithsonian Institution in Washington where they are undergoing intensive study.

"It is important to determine the age of fossil remains," explains Finch, "so that the sequence of loess deposits (the material that buried the animals) can be determined. This will provide useful Geological information on the glacial history of the continent, and add to our knowledge of prehistoric mammals in the Americas." The radiocarbon method is used to determine the age of fossil bones.

The last major ice sheet reached its maximum extent about 20,000 years ago. The wind-blown silt that blankets a large part of the central United States today is the loess that buried the peccary fossils. As the glacial ice melted, after the ice-age, the resulting streams spread mud and rock debris over the countryside. Winds sweeping across the region picked up the finer particles and deposited them as a widespread dustlike mantle over the area.

Sea-going penthouse

It looks like a poor man's penthouse from the outside, but actually it's a scientist's dream. It is a laboratory designed by General Motors AC Electronics-Defense Research Laboratories for development work in deep-ocean acoustic tracking instrumentation, submarine noise measurement and numerous other ocean engineering assignments.

An actual laboratory raised 30 feet above ocean's surface can be upended, lowered 75′ into water and used as observatory.

The strange laboratory, called POP, boasts several pioneering features. There's a portable van that serves as a laboratory with electric instrumentation together with work space and living quarters for four scientists. The laboratory van can be outfitted on shore and transported to the deck of GM's Research Vessel *Swan* and to the perpendicular ocean platform at sea.

To transfer the laboratory, tanks in the upright, spar-buoy-shaped lab are flooded to sink it straight down in the water until its platform is level with the ship's deck and, once secured on the platform, sufficient water is released from the tank to raise POP vertically until its platform is more than 30 feet above ocean surface. The 250-foot long lab serves at this height as a stable, buoy-like work platform. POP also can be upended to a perpendicular position with the compartment about 75 feet below the water's surface and in this position function as an undersea observation cabin and a diver decompression chamber.

Lunar-power-generator

The largest isotope-fueled thermoelectric generator, developed for a moon mission, took off from the St. Paul-Minneapolis airport recently on the first phase of its lunar trip. About the size of a TV set and built by 3M company, it is designed to operate for a year on the moon.

The generator will power a special lunar surface experiment "package" to be used by U.S. astronauts during their first stay on the moon's surface. The power-generating instrument will automatically transmit lunar measurements to earth for at least 12 months after the lunar landing.

3M "moon generator" being packaged in a special container to cushion it on first leg of intended trip to moon's surface.

Operated on radioisotope fuel, the generator is capable of delivering a minimum of 64 watts of continuous power. It is designed to be readily installed and put into operation by astronauts shortly after their moon landing. Measuring approximately 18 inches in height and 16 inches in diameter, the generator is built to withstand the extreme moon temperatures of 170° F. during the day and −280° F. at night.

Fiber-glass fairing is lowered over Deep Ocean Work Boat (DOWB) that houses two-man crew who can remain safely in boat submerged to depth of 6500 feet for maximum of 65 hours. A product of General Motors AC Electronics, the two-man sub is 17 feet long with a 30-mile range, and has a 360° visibility freedom with direct optical systems and a special television camera for undersea explorations

Gaps and gains in matrimony

Some 800,000 marriage-minded young women may not get to the altar because of peculiar quirks of custom and human arithmetic. The quirk of custom lies in the inclination of young U.S. women to marry men from one to several years their senior. Timing of the baby boom has fouled human arithmetic to an alarming degree for would-be wedded young ladies.

Women presently 19 and 20 years old were born in the first two years of the baby boom and now number 3.6 million. Unfortunately for the females, the number of males born a bit earlier, and now 21 to 22, number 2.8 million. The 800,000 difference constitutes what may be called the marriage gap or "squeeze" for the young women. Affected, too, are women of other ages, possibly more than a million from now until about 1975.

Fortunately, the marriage gap is not unresolvable. Trapped women may escape by marrying available older men or men closer to their own age than the preferred two-year spread.

If any consolation to husband-seeking girls, the baby boom which caused the marriage gap for young girls also is pushing marriages to record highs, evidently in older age brackets. For instance, the 1,844,000 marriages in 1966 were the highest annual total in U. S. history, except for 1946 and 1947.

For several years, according to The Population Reference Bureau, women have been marrying at slightly higher ages than in the 1950s. And women who marry in their 20s are more likely to marry men of their own age—undoubtedly a solution for many of the girls facing the marriage gap problem.

The oldest living thing in the world

by Andrew Hamilton

THE late Dr. Edmund Schulman was a dendroclimatologist at the University of Arizona—a scientist who studies tree rings and "hindcasts" what the weather was like in past centuries. He also uncovered a first-rate scientific mystery that has not yet been solved.

In 1953 he heard a fantastic rumor: Bristlecone pines (*Pinus aristata*) in the arid White Mountains of eastern California were older than the 3,500-year old sequoias —up to then considered the world's most ancient living things.

Accompanied by Dr. Frits Went of the California Institute of Technology and Al Noren, District Ranger for the Inyo National Forest, he went for a look.

Noren, who knew where the trees grew, led Dr. Schulman and Dr. Went to the 11,000 foot level and pointed out a gnarled veteran he called "The Patriarch". It was a scraggly, sprawling specimen that measured 37 feet across and not much more in height.

Using a Swedish increment borer, Dr. Schulman twisted the thread-tipped instrument into the heart of a tree and removed a pencil-slim piece of wood. This wood core was then glued to a grooved stick, shaved flat and swabbed with kerosene to make the grain stand out. Then Dr. Schulman examined it under a portable microscope.

"This tree is 1,800 years old!" he said excitedly.

In following summers, Dr. Schulman returned to the White Mountains under the auspices of the National Science Foundation. By 1956 he had found three bristlecones in the 4,000-year bracket—500 years beyond the oldest-known sequoia.

Pine Alpha, an ancient and gnarled bristlecone pine is estimated to be 4,100 years old. An even older tree called Methuselah is believed to be some 4,600 years of age.

After Dr. Schulman's sudden death in 1958, Dr. W. G. McGinnies and Dr. C. W. Ferguson of the Laboratory of Tree Ring Research and at the University of Arizona carried on his research. More than 1,000 trees in the over-4,000 year category have been located. And one—called "Methuselah"—is 4,600 years old.

Bristlecone pines are related to the limber pines (*Pinus flexilis*) and the foxtail pine (*Pinus balfouriana*) which grow on rocky slopes or windy ridges. They are called bristlecone pines because of the black, hair-like bristle on the tip of each cone scale.

Bristlecones exist throughout the entire Great Basin of the West—California, Nevada, Utah, Colorado, Arizona and New Mexico. But all the 4,000- to 4,600-year old specimens are found in the high, dry White Mountains of California. In summer they battle blazing sun and lack of water, in winter they struggle against snow and ice.

These trees grow in a variety of odd shapes, but the completely dead stumps are the wierdest of all. Polished by wind-blown sand in summer and ice in winter, they become grotesque skeletons with reddish-brown arms flung against the blue sky.

Why are bristlecone pines the world's oldest living things?

This was the question that Dr. Schulman could not answer—one that's puzzled scientists ever since.

At least three possibilities have been suggested:

1. The oldest trees might have had more pitch in their trunks and branches, or pitch of a different chemical composition, reducing the likelihood of insect damage or rot.

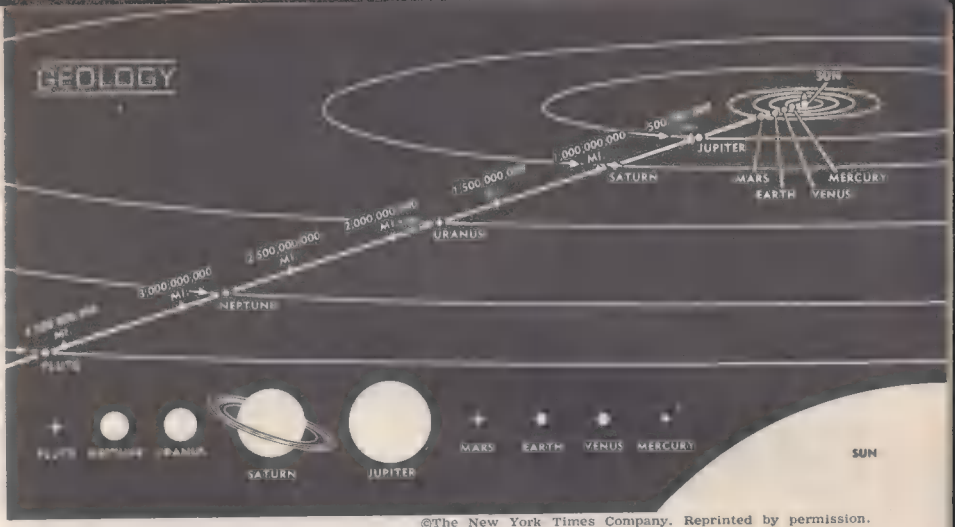
2. Bristlecones have mastered the trick of allowing only a part of themselves to die, so that another part can grow strong enough to survive in a harsh environment.

3. The trees live to a ripe old age because they grow so slowly—the diameter of their trunks increasing only about one inch every 100 years.

The age of bristlecone pines is determined by examining a pencil-slim core of wood taken from the heart of the tree, under a microscope. Work is done at U. of Arizona Tree Ring Research Laboratory.

When word got around that the bristlecones were older than the sequoias, souvenir hunters started to move in. But the U.S. Forest Service in 1958 set aside 20,000 acres of public lands in the White Mountains as the "Ancient Bristlecone Pine Area".

Scientists from the University of Arizona and other instiutions are still at work on the bristlecones. But the mystery remains.



To the planets for gold

It was long-gone suns, not ours, that gave birth to gold. Gold is as abundant on the moon and nearby planets as it is on earth, but unlikely on Jupiter or Saturn.

by Gina Allen

TODAY we face a gold shortage. Last year the Free World mined more gold than ever before—42 million fine ounces, 1.5 billion dollars worth at the official price of $35 an ounce.

Because the mines of the Free World cannot produce gold at this rate past 1970, scientists are speculating about other possible sources—perhaps the moon or near-by planets, or the ore-rich bottom of the sea and the waters of the ocean.

Of last year's new gold crop, jewelry took $375 million and $125 million was used by industry, dentistry, optics and medicine.

Where did the other billion dollars in new gold go? It disappeared into private hoards all over the world. India's hoard, despite stiff penalties, is thought to be in the neighborhood of $5 billion. French citizens are believed to have another $4 billion tucked away against a rainy day. And Swiss safety deposit boxes may have the biggest cache of all, with gold that has been sent there for safekeeping from all around the globe.

The human race has spent a large part of its time on this planet gathering the yellow metal. And what

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has been the total take from all this effort? How big a lump would it make if all the gold mined by all people through all ages were assembled in one block? As big as the Empire State Building? As big as the Pentagon?

If you could melt all the gold man has ever found into one cube, you could fit it nicely into a baseball diamond. It would measure 90 feet in each direction, weigh 100,000 tons, and be worth $122 billion.

That's an astonishingly small return for centuries of effort. Three times that amount of pig iron is turned out every year!

The first men who found gold nuggets thought they had dropped from the sun. They were almost right. Gold does come from the sun—from many suns—but not from *ours*.

Our sun is still young, a celestial cyclotron that creates energy by changing hydrogen into helium. These are light elements. Only when a sun grows old, and is about to die, does it consume itself by turning light elements into heavier ones, including gold.

According to the new cosmology, dying suns have left behind a sprinkling of the heavy elements among the more numerous hydrogen atoms that form interstellar gas. These heavy atoms were part of a cloud that, swirling around our sun, became the planets. The heavier material condensed first to form the four, small, dense planets that move closest to the sun, and the asteroids that orbit between Mars and Jupiter. Occasionally, an asteroid falls to earth where we can examine it and find out what the gold-bearing planets — Mercury, Venus, Earth and Mars—are made of.

You might think we could study the earth first hand, but we can't. We can only study the crust, which is less than 1 percent of its mass. The interior has a different composition.

Gold is rather evenly dispersed through the crust, but so sparsely it almost escapes detection. If you dug for it in your garden you would get anywhere from one to nine milligrams of the metal from each ton of dirt. That would bring you less than 1¢ a ton for your efforts.

If you wanted to reap your penny's worth of gold without effort, you could employ one of nature's mining plants, preferably the *Equisetum Palustre*, which sucks gold out of the soil. A garden planted with this industrious vegetation would harvest your gold but couldn't mine more of it than the soil contained.

You'd do better with a meteorite, for it is 700 times richer in gold than is the surface of the earth. Geologists think there is the same percentage of gold in meteorites, small planets and the moon as there is beneath the earth's crust. Man has yet to explore any of these places.

When the planets were formed, gold settled *beneath* the crust of the earth.

Fortunately, nature didn't wait for man to dig down to the center

It was cheaper for the Romans to let their miner-slaves die than it was to import food and water for them.

of the globe before introducing him to gold. She heaved gold upward through the earth's crust while raising mountains. Then, in the process of eroding the mountains she had built, she concentrated a part of the treasure in river beds.

Because of its lustre, gold was probably the first metal man discovered and used. We don't know when. We do know that some 40,000 years ago Paleolithic men were fashioning crude amulets of gold.

The source of their gold was the river, where they found nuggets, and where the world's first miners learned to separate gold from sand. They accomplished this in much the same way the Forty-niners did in the streams of California. The Californians ran the sand through sluice boxes floored with riffles, and sometimes blankets to catch the heavy gold as the lighter sand flowed off.

Ancient men spread sheep skins in the river bed, letting the fleece catch and hold the gold.

The ability to "create" gold out of sand and fleece gave them a false reputation as magicians, a secret knowledge that continued and was responsible finally for the European shortage that sent the Spanish Conquistadores to search for gold in the New World.

There were long, dark ages in between as the magician-miners learned to follow traces of gold to their source, in mountains, and to recognize signs of gold even in deserts. Hard rock mining was not for the magician aristocrats. They found the gold and directed its recovery. Slaves did the digging.

The Roman historian, Diodorus Siculus, described the mines on Egypt's eastern desert, known as Kush or Akita, from which the Pharaohs took gold for thousands of years. The passageways were so small, he wrote, that the slaves had to wriggle through them like snakes. They worked naked, without food or water or rest, driven to their tasks by the blows of their guards and overseers. Kush was so inaccessible that the Egyptians found it cheaper to replace the slaves as they died at their labors than to transport food to keep them alive.

Another Roman, Pliny, told how his countrymen obtained the golden wealth of captured Spain. They tore down the mountains, a feat that seemed to Pliny "to surpass the achievements of the Giants."

Supervised by Roman engineers and soldiers, the enslaved Spanish natives dug galleries into the mountain, breaking the hard rock with iron rams into chunks of 150 pounds. These they passed along a human chain to the entrance of the shaft. Only the last men in the chain saw daylight until the work was completed.

Arches were left to hold the mountain up. When all had been hollowed out, the arches were cut as fast as possible, while a lookout on the hilltop watched and listened for signs of the mountain's collapse. When these came the lookout shouted a warning and everybody raced away, the dark-blinded slaves often caught in the avalanche as the mountain fell apart. "With a roar that the mind can hardly conceive," was Pliny's description, "and with an equally incredible blast of air."

To get Spain's gold, the Romans changed her geography. Not only did they tear down mountains, but after the peaks fell, they changed the course of rivers so that the water would drop on the debris with force, crushing the rock into sand. This was then run through sluice boxes lined with shrubs to catch the gold. So much dirt was washed for gold that the waste silt, carried seaward by the rivers, filled harbors, extended the coastline, and made inland towns out of cities that had once been ports.

Mining lore lost

When the Roman Empire fell, the science of getting gold fell with it. The secrets of mining and metallurgy, which had been passed on in families, were lost. Amateurs looked inexpertly for gold with divining rods, and generally failed to find it. With more success, adventurers set sail for Africa and America and brought back the gold other civilizations had gathered to build up Europe's dwindling stores.

While the Spaniards were robbing the Aztecs and the Incas, a Bohemian doctor and mine owner, who called himself Georgius Agricola, was learning all he could about mining and metallurgy from the miners he treated as a physician. He tried out the information in his own mine and wrote it down that others might also learn. His remarkable *De Re Metallica,* published in 1556, was the world's first textbook on mining and metallurgy, subjects that had previously been top secret. Another text wasn't to appear for centuries.

Hoover's contribution

As late as the early 1900s, a young mining engineer named Herbert Hoover and his wife, Lou Henry Hoover, considered Agricola's work of enough importance that they spent several pre-White House years translating and annotating the book that formed an important part of the foundation on which modern mining technology was built.

Modern mines, scientifically lighted and ventilated, with machines to do the digging, crushing and hauling, bear scant resemblance to those of the ancient world. With new techniques we can now mine ores profitably with a gold concentration of only ten to twelve parts per million. Yet, with all these advances, few new mines are opening and many old mines have closed.

The experts estimate that South Africa's gold production will reach

A German ship sailed around for four frustrating years trying to extract gold from sea water.

its peak and start going down as early as 1970. Production in every other country in the non-Communist world is already declining. Gold mines in the United States have never recovered from the Government order that closed them during World War II. Last year's production lagged 62 percent behind the prewar output.

Not all this slow-down represents dwindling gold stocks. Mines with reserves in sight for many years have stopped working because they were caught in the squeeze between rising postwar production costs and a prewar price for their product. Given this economic situation, profitably recoverable gold in the Free World is pessimistically estimated at about one billion ounces. If we maintain last year's production rate it will all be out of the ground in less than a quarter of a century.

Will we then have to send prospectors into space to look for more? Though we presume there's proportionately as much gold on the moon and on Mars as there is in the earth, we can't presume that their environments have made it so conveniently accessible as ours. It may still be resting in the center of a ball of matter, completely unattainable.

But there's no need for concern quite yet. There's enough gold close at hand to make every man on earth a millionaire. It's in nature's Fort Knox—the sea. Rivers have been washing gold into the oceans since time began. Some of it is on the ocean floor, waiting to be mined by divers and diving boats.

More of it is in the water itself, which holds in suspension an estimated ten billion tons of gold. This is one hundred thousand times more gold than man has ever managed to wrest from the earth. The unimaginable wealth has long tempted gold hunters, governments and scientists.

In 1924, when Germany was in desperate need of gold to bolster the worthless mark, pay her war debts and rebuild her country, the noted scientist, Fritz Haber, developed a plan for mining gold from the waters of the Atlantic. According to his calculations, each cubic mile of sea water should contain some 90 tons of gold.

So he equipped a ship, named the *Meteor,* on which he sailed the Atlantic for four frustrating years, filtering gold from the sea water that he ran through an ingenious filtration plant on board. Out of every thousand tons of water he processed, he managed to get one gram of gold. It didn't even pay for the operation of the *Meteor.* The great experiment was given up.

Research on the metallic content of ocean waters has continued. The oceanographers have found that, like the earth, certain parts of the ocean are rich in gold while others

are almost barren. There are large concentrations of gold in areas that have been fed by gold-bearing rivers, near Sydney in Australia, Japan, Washington, and San Francisco.

A nuclear-powered desalination plant in any of these places would not only produce fresh water, power, and salt, but would also harvest the water's ionized gold as a valuable by-product. Such plants are technically feasible today and researchers working to perfect them predict that they will be in use before the turn of the century.

Notions for ocean gold

In the meantime half a hundred ways to capture the ocean's gold have been invented and patented. One of the most practical was developed by a professor in Johannesburg, South Africa. Pipes peppered with fine holes would be laid at the bottom of gold-rich areas of the ocean. Lathers containing reagents would be pumped into the pipes to extrude from the holes and, bubbling upward through the water, attract the gold from a weak solution and carry it to the surface in concentrated form. The bubbles would form a foam on the sea which could be scooped off and relieved of its gold by precipitation.

Other methods of mining the ocean's gold make use of nature's aquatic miners—the fish, the sea weed, and algae that store minerals from the sea water.

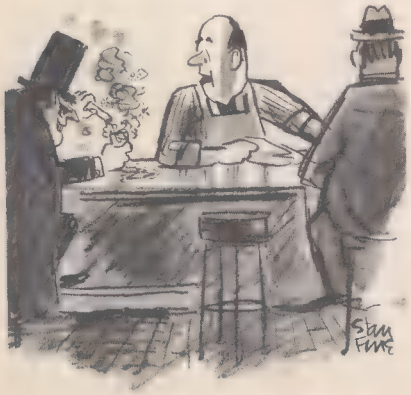
Some specialize in the storage of gold as oysters prefer copper. Naturalists have suggested that gardens of gold-gathering marine life should be planted in gold-rich seas and periodically harvested.

This might be unnecessary. Some twenty-two million square miles of ocean floor is already covered with dingy nodules, some the size of golf balls and some as big as Arnie Palmer. All are rich in metals.

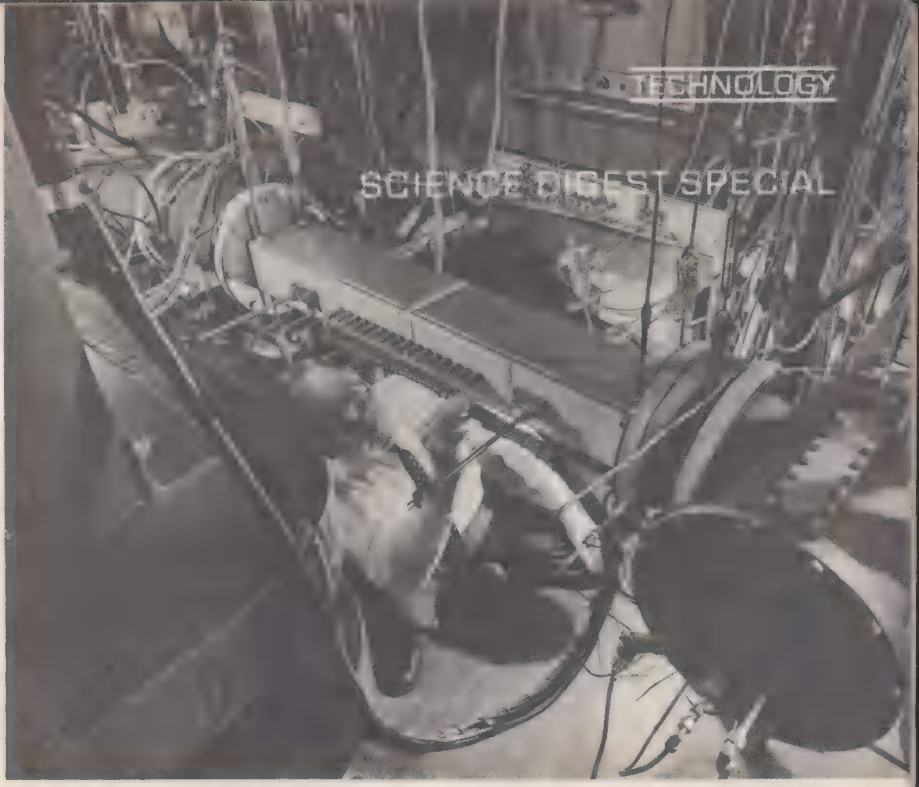
Catalytically deposited from sea water, they contain much manganese, about .5 percent copper, .5 percent nickel, .3 percent cobalt and traces of gold and other metals.

Several commercial companies are studying this rich storehouse of ore, accumulated over millions of years. Presently it is seen only as an emergency source of vital metal, but new technology may well make deep-sea mining commercially feasible.

If this happens, you can be sure a major by-product will be gold—for nothing else so challenges man's ingenuity.



"Look, Buddy, I think you've had enough!"



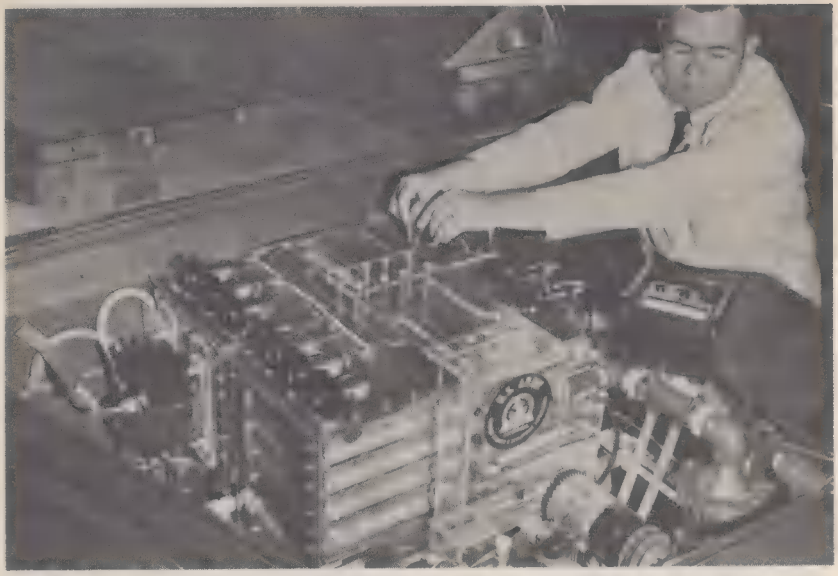
Westinghouse engineer makes adjustment on research model of MHD electric power generator, one of the new power sources now evolving in laboratories throughout the world.

Exotic fuels will power tomorrow

. . . It's coming in cans, on tape, from super magnets, and in furnaces the size of basketballs—to provide the muscle we'll need to run everything from toy trains to moon cities.

by Morton J. Schultz

STOWED away on a shelf at the Atomic Energy Commission's warehouse of "dreams for tomorrow", there's a gadget about the size of a basketball. It's a nifty little reactor called "SNAP" that enjoyed a successful debut powering instruments on a space voyage. If an adaptation of this little powerhouse were buried in a shielded well beneath your home, it would supply all the controlled heat you'd



The first fuel cell powered, electrically propelled Army vehicle is this M-37 truck. It is powered by four 5,000 watt hydrazine-air fuel cells, built by Monsanto Corp.

need for the life of the dwelling. And with a few new and available gadgets added—increasing its size barely at all, and involving no moving parts—it would even convert part of that heat into enough electricity to run all your lights, motors and other conveniences for as long as you cared to remain in residence.

In Vietnam, Army Signal Corps units have been testing "canned" electricity to run their communications gear. One such experimental device is fueled with a standard grade of barnyard manure.

Out in Monsanto's laboratories at Cambridge, Mass., there's a toy electric train that runs on power supplied by a reel of tape.

On a few remote mountaintops, forest rangers are communicating via radio telephones powered by tiny noiseless generators that operate over the candle-like flame of a propane burner. Within a decade or so, such a generator should be able to produce enough electricity to light a good size summer camp.

And for powering entire cities—here, or on the moon—scientists are working on a silent, pollution-free system that shoots a stream of 4,500° plasma at supersonic speed between the poles of giant magnets, producing electric current in the multi-hundred megawatt range.

In laboratories all over the world, scientists have been busy for decades, scouting new ways to produce and contain hotter heat; more efficient ways of converting such heat into power; better ways of storing

Scientist stands beside furnace in which high-temperature fuel cell is being tested.

power so that men can tote it around and use it at will. How are the treasure hunts going?

Surprisingly well! I have just returned from a tour of the hunting grounds and many of the things I saw were eye-poppers. In some cases, yesterday's dreams are being demonstrated by working systems and hardware; others await minor breakthroughs in materials development—perhaps a tougher ceramic to contain heat, a stronger magnetic field, a little more of something vital. In almost every case, exciting goals are in view.

Power on a tape

Up in Cambridge, the Monsanto scientist who took me in tow unveiled a set of electric trains on the conference room table. He lifted a small case—like a tape recorder—and placed it next to the train.

Instead of extending from reel-to-reel, however, the tape snaked through a series of spools.

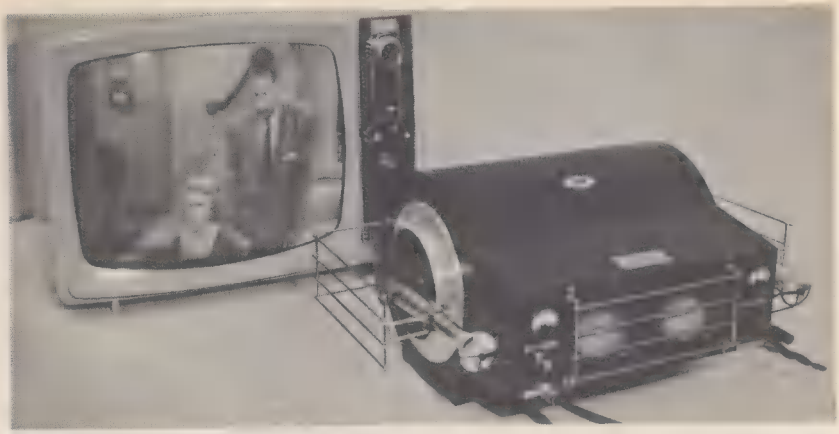
The scientist ran two thin electric wires from the case to connectors on a piece of track and flipped a switch. Slowly the train started to move as he activated a transformer.

My host called it a tape battery. The strip of plastic material was coated with the anode on one side—the cathode on the other. Electrolyte was encased in a myriad of tiny capsules embodied in the coating. As the tape passed through the "crushing" rollers of the "recorder" chemicals were released to start an electrochemical reaction—similar to the way development of Polaroid film is started.

The energy the tape generates is sufficient to operate any small-size electrical equipment such as power tools, radios, fans and the like. Potentially, tape batteries are capable of furnishing 245 watt-hours of electricity per pound of total weight. This is impressive when you know that conventional batteries furnish only 100 watt-hours.

What sort of promise does the tape battery hold for tomorrow? No longer will you be bothered with dry and wet cells that corrode, have limited life, are affected by temperature and humidity. If a tape battery runs out of juice, go to the store and buy a few more inches. When can you do it?

Thermoelectric generators



Of all the exotic fuel sources, thermoelectricity is closest to being in everyday use. Top photo shows how thermoelectric generators can be used to power TV, radio, telephone and other communications equipment. Supplying communications power is expected to be a big potential for such generators. Bottom photo shows how thermoelectricity is already being used in communications in remote and inaccessible areas. A thermoelectric generator installed in the Sierra Mountains is used to provide communications with relay stations. This permits forest service rangers to talk to the central office a good 30 miles away.

"This development," Monsanto states, "is in its early stages, and is only one chapter in a long book on battery technology."

True, dry tape batteries are a new development. But some energy sources—fuel cells, thermoelectricity and magnetohydrodynamics—have been in existence for over 100 years. Where do they stand today?

Canned electricity

Right now the Army is in the process of equipping 100 vehicles with fuel cells that will eliminate the need for petroleum products.

The unique devices have been providing electrical energy for space craft since the first orbit of Gemini-V. They have also been used to monitor the efficiency of the human lung. They've been checking the efficiency of smoke stacks, to help control air pollution. They've been used to operate a standard TV set.

These are interesting developments for an invention that has

lain relatively dormant since its invention in 1839.

If you had a car powered by a fuel cell, you'd still have to "gas up" at service stations.

The attendant might come out with a bottle of ammonia which he'd pour into a filler tube atop the engine. Or perhaps it would be alcohol. Or hydrazine.

The fuel cells Monsanto used to equip the Army's M-37 ¾-ton trucks use hydrazine as fuel, and only four cells in series. The number of cells can be doubled or tripled to increase the speed of a car and provide sufficient power for operating radio, air conditioner, and lights.

How does a fuel cell work? Like a battery, it converts chemical energy to electricity. The chemical reaction between the fuel and an oxidizer produces electron run-off which is used for power.

Unlike a battery, however, fuel cell chemicals aren't confined to a closed container. This is one reason why their potential is so attractive. Chemicals are fed to the cell continuously. As long as fuel and oxidizer flow, electricity flows without ever registering a discharge.

The present drawback to widespread application of fuel cells is to find a fuel and oxidizer that are inexpensive and stable. The most successful cells to date, such as those in Gemini, use hydrogen as a fuel which is too expensive and too explosive for ordinary use.

The answer may lie in the experiments now going on with ammonia, alcohol and hydrocarbons. There's even a slow-acting fuel cell that uses the natural chemical reaction in decomposing manure to supply the heat to activate a thermoelectric current. That one is still pretty far out, though it does, indeed, produce current enough to run a tiny motor.

Once the fuel problem is out of the way, the future of the fuel cell is practically assured—and what a future it promises to be.

Human waste usable

For example, someday missions deep into space may be made possible, thanks to fuel cells that take human waste and convert it into pure oxygen for breathing. Presently, space missions of more than a month are not possible because of the large amount of tanked oxygen that has to be carried aboard.

This technique is accomplished by operating fuel cells in reverse. Instead of feeding in fuel and oxygen to produce electricity, you feed in electricity and a combustible product to produce pure oxygen. Carbon dioxide and water—waste products of humans have been used as the combustible products.

Another life-saving possibility for the fuel cell lies in its potential as a medical diagnostic tool. When operated without a supply of fuel, it becomes a great oxygen detector, picking up as little as one part per million of the gas.

This opens up some pretty interesting possibilities. W. M. Hickam of the Westinghouse physical chemistry department has used

Superconducting magnet and MHD power generator (left) is a vertical unit which has the magnet immersed in liquid helium. White hot gases pass through helium to convert heat directly into electricity.

Dr. Stewart Way, (below) Westinghouse scientist, holds an electrode that's part of the experimental MHD power generator. Model is the first to operate in the kilowatt range (2½ K's for a start) for a sustained period of time.

such a device on people.

"We have found it easy to follow the change in oxygen concentration of the air inhaled and exhaled from the lungs," he reveals.

A person with emphysema, for instance, having degraded lung tissue, would exhale a higher percentage of oxygen, showing a reduced efficiency of lung operation.

In a similar way, the fuel cell oxygen detector offers promise in the air pollution battle by serving as a monitor of furnace fires, sniffing out the amount of unburned oxygen that escapes up the stack.

Hot and cold power

Probably closer to every day use than any other exotic power source is the thermoelectric generator. Like the fuel cell, its basic function is to take energy—heat, light or chemical—and convert it directly to electric power without an intermediate mechanical step. Heart of a future home generator, for example, would be two pieces of thermoelectric material—the same semi-conductor substance from which transistors and other solid state devices are made. One piece would be n-type. A piece of dissimilar material, called p-type, is joined to it. Both are heated by a fuel, such as natural gas, propane, kerosene or whatever.

As the n-type material gets hot, its electrons rush away from the source of heat and bunch up, creating electrical pressure. As the p-type material gets hot, "holes" are created—that is, areas that are void of electrons.

Essentially what has occurred is the creation of opposite poles, like those of a magnet. The electrons from n-type rush to fill the voids in p-type, creating voltage.

Right now, small thermoelectric generators are being used in remote locations where there is no other source of power. The U. S. Forest Service, for instance, has one on an Oregon mountaintop to allow forest rangers to communicate with a central office 30 miles away via radio telephone. Another generator, in a remote valley, operates a weather station and telemetry system to transmit weather data to a central location on command.

Present thermoelectric generators provide up to 100 watts of power.

"Power of up to two kilowatts will be common for thermoelectric generators in a decade or so," predicts R. R. Dahlen of 3M Company's isotope power products department. "When they get bigger, they can be used for powering world-wide telephone, radio and TV communication, doing away with every telephone and electric utility pole and trans-ocean cable."

The beauty of the thermoelectric process, however, transcends its usefulness as a power generator because the process is reversible. Instead of using a difference in temperature of thermoelectric materials to maintain a flow of electricity, a flow of electricity can be used to produce a difference in temperature. A thermoelectric refrigerator has already been developed. It's a compact one-cubic-foot box that was built by Westinghouse for use in space.

According to C. J. Witting, vice-president of consumer products, "thermoelectric refrigeration is achieved simply by passing an electric current through the proper kinds of semi-conduction materials. It requires no compressor, refrigerant or apparatus with moving parts."

It is conceivable that a thermoelectric generator in your basement could one day supply all your electrical needs—heating, cooling, light.

High-powered MHD

Akin to the thermoelectric generator, but much bigger in size and output, is the magnetohydrodynamic (MHD) generator. It, too, converts heat directly to electricity.

Like a giant blowtorch, it shoots a stream of white-hot plasma at near supersonic speed between the poles of a magnet. The gas, in effect, substitutes for the moving wires of a conventional electric generator and is hot enough to conduct electricity. Currents in the multi-hundred megawatt range already have been obtained.

What can you do with this type of generator? Take a look at the city of the future. Erected on the outskirts is an MHD generating plant. It has tremendous advantages over its predecessor, the steam turbine. MHD generators possess few moving parts, reducing the possibility of breakdowns that cause power blackouts. They're smaller

and less costly than systems now in use. And they don't burn fuels to pollute the air.

Present obstacle to MHD generation is to find a material that can hold up under the 4500° temperatures needed to produce high current output.

"Ceramic materials might hold the answer," Dr. Stewart Way of the Westinghouse Research Laboratory says. A ceramic-equipped MHD generator already has been kept in operation for over 100 hours.

An interesting sidelight to MHD generation is that it's a cheap way to produce chemical fertilizer. MHD waste products are compounds of nitrogen that are easily converted to nitrates.

Atoms and sunshine

What happens to all our utility companies if these things all come to pass? Don't worry, they'll probably sell you the units. Right now these companies are in the process of putting into effect another "space age" energy source: nuclear reactors for generation of electricity.

Commonwealth Edison Company of Chicago, for instance, has announced plans to build a 1,100,000 kilowatt nuclear reactor plant in addition to others already underway. Con Edison of New York has a plant in operation, one of 873,000 kilowatts going into use in 1969, and a third of 965,000 kilowatts planned for the early 1970's. Pacific Gas and Electric Co. is in the process of building a nuclear generating station of 1,060,000 kilowatts.

The advantages of generating electricity by nuclear energy are well known. It will eliminate coal and oil burning of present generating stations that contribute to air pollution. Another advantage is saving of money.

According to Pacific Gas and Electric, its proposed atomic power plant will cost $50 million less than an equivalent energy supply of natural gas and oil.

There is a final energy source in existence that should be mentioned briefly. Solar cells were used in some space projects—Telstar, for example. These convert light energy directly to electricity by using a semiconductor material such as silicon. In a way, it's a thermoelectric generator fueled by the sun's heat. For this reason, emphasis on this method of producing power has diminished. Long hours of darkness and cloudy days limit earthbound uses of solar cells, and a spokesman for the Bell Laboratories told me that further development of the method is unlikely.

How long will we have to wait for all these fantastic new sources of electrical power? Some believe that they're a long way off.

But the fact remains that although there are major problems to overcome, all have performed in the laboratory with excellent results. This fact has lead even some reticent types to admit that the advent of "future" power sources may come sooner than many people expect.

Significance of new developments to industry, business, professions

• *Automotive*—Fuel cells will have tremendous impact. Engines with their multitude of parts will cease to exist. Auto parts manufacturers will switch to parts required by the fuel cell engine—the cell itself and related wiring, for example. The auto manufacturers will have more leeway in design, since small stacked fuel cells take up less space than engines, but produce equivalent horsepower.

• *Chemical*—A tremendous responsibility will be placed on this industry to find and supply chemicals that can lead to effective and long-life dry-tape batteries and fuel cells.

• *Electrical Appliance*—This industry can undergo a virtual revolution. The number and efficiency of portable appliances, such as TV sets, power tools and small refrigerators, will be increased as a result of dry-tape battery, thermoelectric generators and fuel cell.

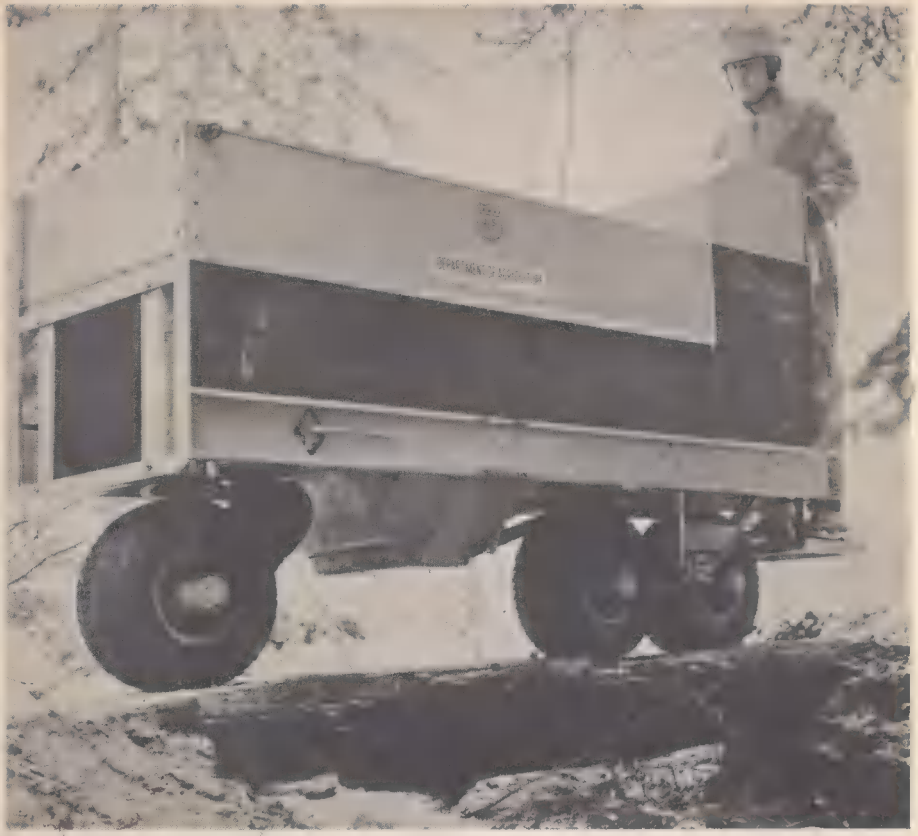
• *Fossil Fuel*—Gasoline for use in cars will no longer be a factor when the fuel cell reaches perfection. The industry will be called upon to find new and better fuels for these generators.

• *Glass and Plastic*—Supplies of glass and plastic to the auto industry will increase many times because of fuel cells. The cells are encased in them. Conversely, this area of supply long met steel will be curtailed.

• *Medicine*—Fuel cell technology will be refined to allow development of better diagnostic equipment to measure man's ability to breathe.

• *Space and Ocean Research*—Deeper and longer probes into space and ocean will be possible by allowing man to "breathe" his own waste. Weight of space and deep ocean craft will be reduced, Refined fuel cells will eliminate batteries, with all their drawbacks.

• *Utility companies*—Much as nuclear reactors today are changing the thinking of utility companies. New generators like MHD, could have a tremendous effect. More electricity will be produced at less cost by fewer generating plants. The absence of moving parts will virtually eliminate power failures. In addition, thermoelectric generators could curtail electrical supply by these companies to homes, farms and businesses.



Gyro-stabilized land vehicle, balanced by 180-pound gyro, travels up to five miles an hour with 800 pounds of cargo. Vehicle climbs ordinary obstacles and 60 percent grades, has cargo capacity of 800 pounds, equal to four pack mules, and may replace the animals on the 88-thousand miles of trails in the nation's forest system.

"Inca" plastic-bricked houses are on the way. The rigid bricks weigh less than 14 ounces and are hollow, allowing electrical wiring and plumbing to run through them. The whole brick is cast in three sections, can be clipped together and carried and placed in position by builder. They are resistant to rain, heat and strong winds.

Battery operated, experimental lineless telephone connects with telephone network via radio link to fixed station connection such as telephone or extension line. Fixed station uses four and one-half foot antenna. Portable phone and fixed station provide two-way simultaneous conversations, and also dials and rings like an ordinary phone.

Test platform, provided by Enstrom helicopter for new radar system developed by Lockheed Electronics Co. Scanning System is evaluated with aid of two airborne 16mm Model IIIB Multidata cameras made by Giannini Scientific Corp. and can be pulsed in sequence with 'copter rotor blades with radar antennae on top.

Sound barrier to drown out noise, developed by Stadri Products Co., makes a snug comfortable fit, giving coverage to total ear area. Sound barrier locks out noises, helps total concentration and is a safety factor in the prevention of hearing loss. New design allows headgear such as protective helmets to be worn over barrier.

Why people riot

by Flora Rheta Schreiber and Melvin Herman

PUNCTUATED by the roar of unruly crowds, the sharp, sickening crack of sniper fire, the crackle of fire and whine of sirens, this past summer has shaken America to its roots. Detroit, Milwaukee, Cambridge, New York—in city after city front page headlines blared the grim news.

Why? Civil rights? Injustice? Unequal opportunity? All those words got a huge play; in city, state and federal governments, committees were formed to get at the base of the trouble.

Why *do* people suddenly rise en masse to vent a collective rage—and why in America? What have other countries got that keeps their people so calm and happy?

The fact is that we are *not* alone with our riots. There are some lulus breaking out in some very unlikely places. What's *really* behind such aggressive behavior?

It is undoubtedly small comfort to the people of Detroit to be reminded that it doesn't only happen here. But Dr. N.W. de Smit, head of the department of social psychiatry, University of Amsterdam, the Netherlands, an eminent social psychiatrist who has studied the pattern of rioting, made it clear to us recently that riots take place not

U.P.I.

National Guardsmen and state police help overwhelmed local police in Newark, New Jersey's largest city, quell rioting and looting last July after a second night of major violence by uncontrollable mobs.

only in the festering ghettos of America, but also in European cities which are relatively free of the obvious problems of the United States. Quiet Amsterdam, for instance, has been plagued with riots for the past few years.

Holland is a welfare state where nobody starves, nobody need fear a destitute old age, or the rising costs of medical care. Yet riots, neither of racial origin nor economically motivated, do take place. These outbreaks elsewhere in the world do not excuse us for our own ghettos or the way of life forced upon the Negro in the United States. But their existence makes us realize that there are basic underlying causes for revolt other than the problems immediately confronting the American Negro.

About Holland, Dr. de Smit told us: "Our riots were a protest against the established order. The rioters felt that traditional society must be challenged and that only maximum disruption could set the stage for social change."

These 1966 outbursts were the culmination of a long series of events that began in the late 1950's. Groups of disorderly adolescents converged on the big cities of Europe. In Holland they were called "nozems", in Germany, halbstarken", and in France, "blousons noir".

Until 1965 these chaotic groups had been only nuisances. A Dutch social scientist reported that while each group had its passive participants, each also had one or two active provocateurs who were psychologically different from the rest. He called the provocateurs "provos" and they themselves later adopted the sobriquet.

Dr. de Smit points out that even taking a psychiatric view might do them an injustice. "The danger is that psychiatrists may see social protest as mental illness. The truth is, however, that protest and the possibility of protest are an essential part of human existence. They have an important part to play in psychological and social development."

"Protest is creative," said Dr. de Smit." By challenging an established order the protester defines his own personal identity. Protest is also therapeutic. Marching, letting loose a howl of protest, releases pent-up emotions which otherwise might turn the protester into a rigid neurotic or lead him into a nervous breakdown. Perhaps many people, outwardly tranquil but inwardly turbulent, whose protest is sown in becoming "sick" would do better to march off their anger.

"When the protest becomes an end in itself and does not lead to greater awareness, the protester becomes just one more 'against everything' neurotic. An inability to protest at all is an even more serious hazard, for the absence of protest doesn't mean that the individual has no reason to cry out. Subtly and insidiously, the protest finds devious outlets, often in the various forms of social or psychological dysfunction."

Social, personal conflicts

This conflict between the interests of society and of the individual challenges psychiatry. "The traditional role of psychiatrists who would study 20 or 200 maladjusted rioters is not enough," says Dr. de Smit. "We must address ourselves to the causes of the disturbance. The question is not how to stamp out a single disturbance and to restore law and order, but to make the disturbances impossible by denuding them of the psychological purposes they apparently serve.

To do this, psychiatry must fulfill two chief needs: 1) to establish an effective and efficient organization of mental health care for the members of the community who need it; 2) to serve as consultants for those social problems, such as riots, that confront the community as a whole. "It would be preposterous to suggest," says Dr. de Smit, "that a psychiatrist should treat the community as if it were a patient in the way that the family therapist treats the family. On the other hand, social psychiatry, or community psychiatry as it is sometimes

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Miss Schreiber is an award-winning writer on psychiatry; Herman, the Executive Secretary of the National Association of Private Psychiatric Hospitals.

Protesting against established order, rioters feel they must challenge traditional society.

called, cannot ignore contemporary social problems."

Dr. de Smit sees riots as a challenge to the police as the guardians of the establishment. The riot is a fiesta that gets out of hand and becomes destructive, but it *is* a fiesta —dramatic and ritualistic. It's a grim Christmas, a national holiday. The 'fiesta' even follows the classical dramatic unities of time, place, and action. Once the fiesta is over, the "celebrants" resume the regular tasks of daily life, purged and fulfilled.

Again and again the same disturbance is repeated with different actors; each act provokes a response, and the social system reaffirms itself. Without this reaffirmation, the disturbance would not serve its purpose. When the system, through arrests, trials, and other legal procedures, shows that it can bring the riots to an end, the rioters have psychologically achieved what they in actuality seem to deplore. The rioters want an ending.

Street-riot social lab

The rioters in Amsterdam or Detroit make the streets a laboratory that challenges society.

Life in the Negro ghetto is worse than life in a European city, but the question remains whether fulfilling the Negroes' demands would remove their anger. While new housing, better schools, and more jobs will go a long way toward improving the life of the protester, whether he be an American Negro or a Dutch provo, these in themselves will not remake his life nor quell his need to protest.

Bread not enough

The protest also involves his isolation, the mistrust he senses, his alienation from society. A housing project on either side of the ocean will not quiet the restlessness of a person lost in a world he never made. In Baltimore, Maryland, for instance, 400 Negro families consisting of 2,000 persons who moved from the slums into a new housing project were compared with 600 families, including 3,000 persons who remained in the slums. Family compatability or personal fulfillment were not bettered with improved housing. Housing alone, like bread alone, will not bring surcease to the embittered life. These disenfranchised protesters feel an underlying sense of powerlessness. The community must provide not only a job, but one that makes a man feel he is somebody. Unless he has this sense, he will go right on exemplifying James Baldwin's contention that "to be a Negro in this country and to be relatively conscious is to be in a rage almost all the time."

"Events in Holland show," says Dr. de Smit, "that it is incorrect to assume that the community is ready to accept psychiatric advice in community matters."

Clinical way is conservative

The community is perhaps suspicious of the psychiatrist because it does not draw a distinction between the social or community psychiatrist and the psychiatrist who is primarily concerned with the individual psyche. The social psychiatrist dismisses the clinical, curative approach of individual treatment as static and conservative. He also rejects the labeling and consequent stigmatization that are involved in making a diagnosis. Above all, he is wary of the armory of techniques and drugs the psychiatrist uses with individual patients as being a potential danger to the community. Still another reservation the social psychiatrist has is that by wishing to help people become free, the psychiatrist can become the inadvertent instrument of serving political purposes and of being used by special interest groups.

The social psychiatrist places his hope in the therapeutic community, a place where everything is planned for the benefit of the person. Some hospitals have been organized as therapeutic communities. The community itself must somehow be made to take steps to be therapeutic.

Recently, psychiatrist Harold W. Jones, M.D. took writers on a tour of Watts. Joseph Coogan in the *Psychiatric Reporter* described the new business district of Watts as an attractive area of shops, super markets, banks, and business offices. But he also saw a full city block that was as empty as if it had been bombed out. He seconded some of Dr. de Smit's views. "The people in Watts, for example, aren't trying to change the system of discrimination. They feel that will always exist. But they're trying to better their position in that system. They've developed a nationalistic feeling. They don't speak of the Watts riots, for example; they speak of the Watts 'revolt'. For a lot of them, it had a healthy effect. It increased their self-esteem and their feeling of brotherhood toward one another."

Change the system

"Some psychiatrists say that social upheavals like the riot are outside our professional concern; to me that's a cop-out. Watts is a city that should be built, not burnt. I'd like to see the people here help build it. If I could have a dream come true, I'd like to see Watts become a center of culture, a beautiful city. But all that is really fantasy as long as the people are forced to live under a system that breeds poverty, apathy, violence. I don't see how in the world you can avoid trying to solve social issues. The only alternative would be to give up and say: 'Well, we can't do it, so it isn't worth a damn to try.' "

The 50,000,000 year-old bat

Science magazine

An extraordinarily well-preserved fossil skeleton of an early bat (shown above) was found imbedded in Fossil Lake in Wisconsin's Green River Formation. The bat had apparently died there some 50,000,000 years ago.

Because of its peculiar combination of features, the fossil has been designated as a new species, *Icaronycteris index,* and has been assigned to the suborder Microchiroptera of the order of Chiroptera (the category of all flying mammals).

So complete is the fossil that delicate remnants such as wing membranes, rib cartilege and fragments of food eaten shortly before its death were preserved intact.

Clearly such a superb specimen (fossil bat skeletons are extremely rare) should provide considerable data about the origin and evolution of the bat.

But when was it found? About thirty-four years ago.

It has taken all this time before an analysis of this unique find was ready to be published. The report was written by Glenn L. Jepsen of the Department of Geology, Princeton University and published in *Science* magazine. So large a hiatus between discovery and results of appraisal is not unusual for the science community.

Most of the skeleton is in astonishingly good shape, although the shell-thin top of the skull is shattered. The lower jaw has been pressed into the skull so that the cusps of the teeth have pierced it. That means the laboratory can examine the all-important tooth structure without further damage to the crushed skull. All of the 254 bones (if the skull is counted as one unit) and 38 teeth in the solid skeleton, except some of the 44 sesamoids in the wings and feet, have been studied on both sides.

Some characteristics of the fossil bat are unspecialized, primitive features: large number of teeth; index claw; big toe shorter than others; etc.

But these primitive traits are combined with a physiological amalgam of different features resulting

in a bat well-developed for the early Eocene period in which it lived.

Its index claw, for instance, is typical of the Megachiroptera, the Old World tropical fruit bat, which needs that structure to pick and hold the fruit but has teeth with a simple crown pattern to chew the food. Instead of this simple tooth structure, the fossil has the W-shaped molars typical of the Microchiroptera, the insect-eating bat that is distributed throughout the world. This suborder needs molars with the stronger, more sophisticated W-shaped external wall in order to chew insects.

The fossil is male by the look of the small club-shaped bone at the rear of the pelvis which resembles the bacula of some small bats. The teeth exhibit the heavy wear of a 2-to-3-year old microchiropt. Feeding habits, of the bat are presently unknown, but fecal deposits near the posterior of the pelvis when fully identified may contain insect chitin, fragments of bacteria, algae, pollen, spores or other remains that will help scientists determine the animal's diet.

Bone positions—wings folded and the femora at 45° angles to the spine—are considered normal for a dead bat in water.

How the bat died though, is a matter of speculation. There are no signs of disease, functional failure or injury. If a predatory fish or bird had killed it, it would also have eaten it. Lightning or hail is possible but considered unlikely. Whether the bat died on land and was subsequently carried to the lake or died in the lake is also not known.

Fossil Lake, the lake in which the fossil was discovered, is located in the Green River Formation which in ancient times encompassed the present Wyoming-Colorado-Utah region. In early Tertiary times, sediments of this formation settled in basins of several lakes one of them being Fossil Lake. The entire sediment mass of the lake has been designated by potassium-argon tests as early Eocene age, the lowest level being about 49 million years old.

The stratum in which the bat was found, according to analyses of the material, developed in a humid, subtropical climate similar to Alabama's today.

The varves in which the bat skeleton was encased is soft compared to the bat's brittle bones. This matrix is composed of two alternating layers of fine-grained elastic material. The thin dark-brown layer sifted to the lake bottom between deposits of a blanket of carbonate, a thicker, buff-colored layer, giving the sediment its marbled effect.

A fog still surrounds questions concerning *Icaronycteris Index:* the rate of evolution of separate varieties of bats; the significance of its connection, if any, to birds and other bats; whether it is an ancestor of existing micro- and or megabats and how its highly sophisticated audioresponse system developed. Comparison to other Tertiary fossil bats has not been possible since other bat finds have been confined to a later period (mid-Eocene to Recent).

Under those wet sheets, a 300-pound dolphin is kept comfortably cool as she talks dolphin language for benefit of an X-ray motion picture camera and tape recorder recording historical event for posterity.

Dolphin talks for talkies

Cynthia—a 300-pound dolphin—gave a sparkling performance in Professor Pierre Delattre's unique speech synthesis research laboratory at the University of California. She was the star of the first X-ray motion picture ever made of a dolphin's amazing "speech" apparatus in action. She whistled and clicked while the camera and special tape recorders made permanent records of the show.

Professor Delattre explained that the speech of a dolphin does not involve the use of the mouth or beak as it does with human beings. The larynx of the dolphin, completely separated from the eating apparatus, sends its sounds through a blow-hole which permits it to "talk" underwater as well as above, and much louder submerged than when surfaced.

The X-ray video tape, noted the professor, clearly shows how the dolphin produces a variety of loud signals for communication with mates. A dolphin's high frequency sounds are above human reception, so in order to record Cynthia's

"voice", a hydrophone was placed by her beak, another behind her head, and an air microphone synchronized the sounds. The mammal's repertoire of whistles and clicks enabled the researchers to obtain excellent video tape of the shape and volume variation of the nasal tube which joins the dolphin's larynx to her blow-hole.

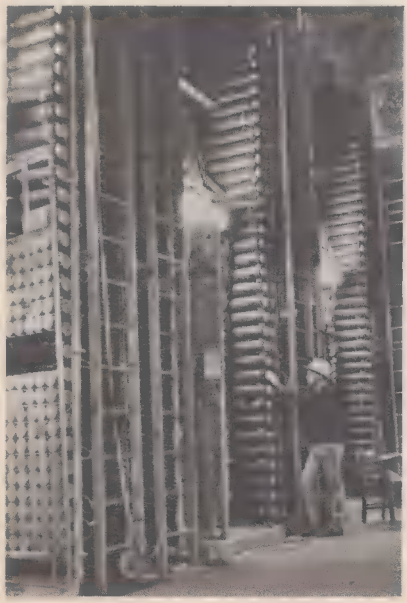
Outer space trap in mountain

Two thousand feet under the summit of Utah's Treasure Mountain, a huge detector sits in a chamber at the end of a three-mile tunnel and studies, the amazing penetrating power, neutrinos, tiny subatomic particles from outer space.

Two similar exploratory projects are underway in South Africa and India. But the neutrino trap, built by the University of Utah, is the only one of its kind in the world. In addition to detecting neutrinos passing through the trap, the counters record the direction in which the neutrinos are traveling. A visitors' gallery, equipped with flashing neon bulbs, permits tourists to view the cosmic-ray particles as they plunge into the trap from outer space.

The project is directed by Dr. Jack W. Keuffel, professor of physics at the University of Utah and an internationally recognized authority on neutrinos.

Dr. Richard O. Stenerson—University of Utah physicist—is busily engaged by huge million dollar cosmic ray trap 2000 feet underground in a three-mile tunnel in heart of a Utah mountain. The trap studies subatomic neutrinos from outer space.



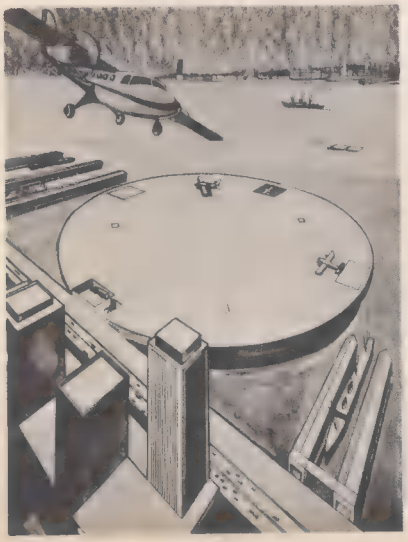
Keeping "sleeping" cabbage

Agriculturists are excited over an experiment that may give them a year-round cabbage business, thanks to researchers at the New York State College of Agriculture, Cornell University. Professor F. M. Isenberg learned from a two-year laboratory study of cabbage storage, under controlled atmosphere conditions, that disease-and-insect-free cabbages can be stored successfully through the winter.

Cabbages brought out of the laboratory after winter storage had heads as green as when placed in bins the previous fall. They showed very little loss in weight, needed almost negligible trimming, and were sweeter than when placed in storage.

Professor Isenberg explained that under controlled-atmosphere storage, in which respiration of the cabbages is slowed, the amount of oxygen was reduced and the amount of carbon dioxide increased. Storage temperature was maintained at 32° F. Used in the project were small, gas-tight boxes under laboratory conditions to simulate storage bins. The experiment will be repeated on a larger scale this winter.

New concept devised by Rutgers University is aquadrome or floating airport designed to aid mass transportation in large urban centers. Top would be used as flight deck with two parallel runways for take-offs and landings. Bottom serves as a hangar.



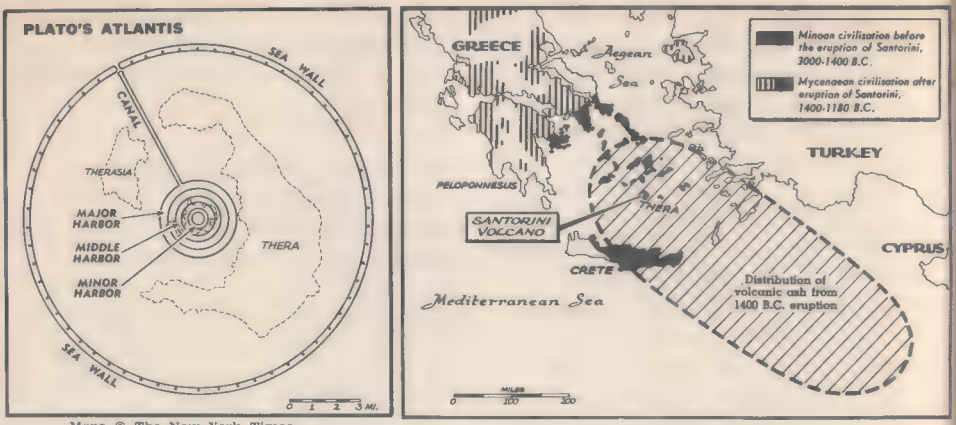
Floating airports

The floating airport or aquadrome is a new concept devised by Rutgers University to aid rapid mass transportation in large urban centers of the United States. The circular floating airports provide an omnidirectional landing and launching capability for continuous operations under any wind condition.

The aquadrome's relatively shallow draft when compared to its size makes it employable in any water area, including rivers, lakes and tidal estuaries. The aquadrome's characteristics permit location close to many city centers and areas of high concentration of passengers and freight without using expensive land.

Feasibility studies established that an aquadrome can be constructed of reinforced concrete and anchored into position without being affected by wind and water currents. When floating in water, the top will be used as the flight deck and the bottom—the inside cylinder—the hangar deck. The flight deck has two parallel runways for take-off and landings and four heliopads.

Passenger and freight terminals and all support facilities required for airplane servicing and air operations are located on the hangar-deck. Overall dimensions of one aquadrome concept are 1000 feet diameter, 16 feet inside height, draft 12 feet and freeboard, nine feet.



Maps © The New York Times

A map of Plato's conception of Atlantis is superimposed on a map of Thera. Map at right shows how the explosion of Santorini may have affected Minoan civilization. Mycenaen Greeks took over control of Aegean area after the fall of the Minoans.

Is this Atlantis?

A volcanic explosion that wrecked a strange civilization may have given Plato the inspiration of the legend of the "lost continent".

by Daniel Cohen

THEY have found Atlantis—again.

The famed "lost continent", which was populated by a near perfect race and destroyed "in a single day and night of misfortune" has been "located" many times.

The story of Atlantis was first told by Plato in about 355 B.C. He claimed that he got it from a relative who had heard it from his grandfather, who heard it from his father, who got it from the Athenian leader Solon, who had heard it from an Egyptian priest. According to the Egyptian, Atlantis had existed nine thousand years before Plato's time. This sort of hand-me-down evidence is not very convincing, and Plato was not a historian. The information about Atlantis is contained in two philosophical dialogues, *Timaios* and *Kritias*. In such works Plato often invented allegorical events to make a philosophical point. Most people have regarded Atlantis as just such a fable, for aside from Plato's dialogues there is no other source of information on Atlantis in ancient literature.

Over the centuries, however, a number of people have become convinced that there was a real Atlantis. Thousands of books, theories and articles have been produced on the subject, most of them by a wild assortment of crackpots. But in the last few months a group of respected scientists and scholars have announced discoveries which they believe cast new light on the ancient mystery of Atlantis.

Some 3,500 years ago, there was a tremendous volcanic explosion in the Aegean Sea. At the time the area was ruled by a people known as the Minoans, a great seafaring nation centered on the island of Crete. We have known about the existence of Minoan civilization for a long time. The Minoans were a highly advanced people, but their history, particularly the reasons for their sudden downfall remains shadowy.

What does all this have to do with Atlantis? A group of islands near Crete look as though they had been drastically altered by an explosion of the volcano Santorini. Early in the 1960s a Greek seismologist, Angelos Galanopoulos, began advancing the idea that a buried Minoan city on Thera, one of the islands, might have provided Plato with the inspiration for Atlantis.

Since then scientists from many countries have investigated Thera, a good part of which is now sunk beneath the waters of the Aegean, and decided that Prof. Galanopoulos may be right.

What they have discovered is that ancient Thera contained at least one wealthy Minoan settlement that was destroyed in the eruption.

Plato described Atlantis as a sea power where "consecrated bulls roamed at large". The Minoans did possess a great navy and bulls figured importantly in their religion.

Thera and the other islands of the Aegean group are part of a gigantic submerged volcanic crater. Plato describes the city of Atlantis as a fortified hill protected by alternate rings of land and water. Plato also mentions that the center area had hot springs. All this sounds rather like a fanciful description of what Thera may have been like be-

Volcanic ash filled the houses of Thera and acted like excelsior used in packing. It protected the structures, and even delicate oil storage jars (shown below) from the shocks of the earthquakes which must have followed the great eruption.

U.P.I.

fore the catastrophe.

Dr. Galanopoulos has cleverly fitted another piece of Plato's story to Thera. Plato said the destruction of Atlantis came 9,000 years before his time and that the land was a continent hundreds of miles square, bigger than North Africa. Dr. Galanopulos says that Plato made an error and multiplied both of these figure by 10, thus giving the impression that the relatively recent and small Minoan island civilization had in reality been a great continent of almost incredible antiquity.

Ruined civilization

The destruction of Thera was not as bad as the sinking of a whole continent—but it was bad enough. Oceanographers have found ash deposits from the explosion over a wide area of the Aegean. Dr. Bruce C. Heezen, an American oceanographer who has been studying the problem, believes that the Santorini explosion was similar in type to the 1883 explosion of Krakatoa, but far greater in magnitude. The Krakatoa eruption destroyed several small islands, generated tidal waves that swept around the world, killed more than 36,000 people, and released enough volcanic ash in the atmosphere to color the world's sunsets unusually red for an entire year.

Dr. Heezen thinks that the ash deposits laid down in the Aegean 3,500 years ago were so thick that they ruined Minoan agriculture, and brought the civilization to its abrupt and mysterious end, in around 1400 B.C. (However, some scholars recently have severly questioned the idea that Minoan civilization was destroyed in 1400 B.C.).

The discovery on Thera is a great one. Reporting on recent excavations at Thera, Boston University called the site "the first intact Minoan town ever discovered". Atlantis or not, this makes the discovery one of the most important archaeological finds of the century. An underground museum is planned to give visitors a look at ancient Minoan life without disrupting modern life on the island.

The Minoan town covered about half a square mile by present calculations. Most of the residents dwelt in small close packed two and three story houses, although one much bigger abode, perhaps the villa of a nobleman has been uncovered.

The best thing that can happen to a city, from an archaeological point of view, is that it be completely buried by a convenient volcano. This is what happened to the Roman towns of Pompeii and Herculaneum, and why they are wonderful archaeological sites.

The volcanic ash at Thera preserved painted frescos and wooden objects that would have been lost forever if the city had been allowed to fall into natural decay. Huge pottery jars for the storage of oil and wine were dug unbroken, out of the ash. Under other circumstances they would have been smashed to fragments.

At Pompeii and Herculaneum, the

The people of Thera took their gold and fled the doomed island before disaster overwhelmed it.

eruption of Vesuvius was sudden, (people had some warnings of the impending disaster, but ignored them). A good portion of the population was buried in the ash fall. Perfect casts of bodies caught in their final agony are among the grisliest and most compelling sights in Pompeii. No such disaster befell the people of Thera. Excavations have so far uncovered only two human bodies, although there are remains of domestic animals.

Also missing from Thera are gold and other precious objects. Apparently the volcano gave plenty of warning before it finally blew apart, one expert estimated the rumblings may have gone on for as long as fifty years. The residents of Thera were wise enough to heed the signs and depart.

So vast was the destruction that James W. Mavor Jr. of the Woods Hold Oceanographic Institute believes that several Minoan sites may have been buried.

Undoubtedly our knowledge of Minoan culture will be increased dramatically within the next few years. But all this still does not answer the intriguing question: Have we really found Atlantis?

If Plato multiplied both the size and age of the Minoan cities by 10, he committed a pretty major error. Even allowing for a systematic mistake of such magnitude, how did Plato confuse cities in the nearby Aegean with a place in the distant Atlantic? He was quite definite about the location of Atlantis, even adding that the sinking caused such a violent upheaval that for a time passage through the "Pillars of Hercules" (Straits of Gibraltar) was blocked. There are other details about Atlantis which do not agree with what we know of the destruction of Thera or of Minoan life.

It was not the historical or geographical details that were important to Plato. Primarily he was concerned with writing a moral fable. His Atlanteans were a noble race living under a perfect government. But they fell into moral decline, and came into conflict with the ancient Athenians, Plato's own ancestors. The Atlanteans had sunk so low that the gods decided to punish them. In one of the dialogues Plato briefly describes the destruction of Atlantis. In another he has a more extensive discussion of Atlantis which ends with the decision of Zeus to punish the now evil Atlanteans. Zeus calls the other gods together to discuss the punishment. ". . . and when he had assembled them, he spoke thus: . . ." The dialogue ends in mid-sentence.

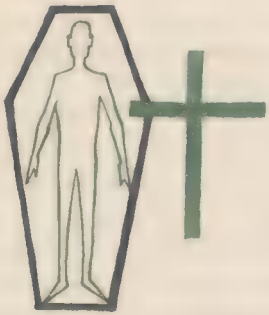
The discovery of the buried Minoan cities may finish the unfinished story of Atlantis. On the other hand, many previous claims for the site of Atlantis have been made. Perhaps the story of Atlantis will always remain the way Plato left it—unfinished.

MEDICINE

When is a person dead?

by Arthur J. Snider

THE definition of death is a question that has long concerned physicians. Now it is concerning philosophers, theologians, moralists, lawmakers, judges and many others. There is no legal definition of death based on twentieth century medical facts. Even when it is apparent that the patient is near death, he can be kept alive for days, perhaps months more with



stimulators, respirators, intravenous solutions and other resuscitative devices.

Dr. Frank J. Ayd, Jr., of Baltimore stresses in "Medical Science" the urgent need for a modern definition of death and for guidelines which will empower a physician to decide when he may legally cease employing extraordinary measures to defer clinical and biological death. He underscores the problem by citing two recent cases in Sweden.

An 80-year-old woman, hospitalized following a cerebral hemorrhage, had no chance for recovery. Nevertheless she was maintained for five weeks by intravenous therapy. Her physician concluded that to continue would be futile and that it was inhuman to prolong her suffering. He received permission from the relatives to stop the intravenous therapy and the woman died.

The same physician, treating a 65-year-old patient in a diabetic coma, decided the outlook was hopeless and again sought relatives' permission to stop life-sustaining therapy. It was not granted. The case came to public attention when the son accused the physician of planning to kill his mother. The Swedish Central Medical Board charged the doctor with neglect and found him guilty but the courts overruled the finding, pointing out the doctor had acted properly both times.

"When the circumstances justify it, the law should recognize that a physician should be permitted to discontinue extraordinary means of sustaining life when clinical death is imminent and inevitable," said Dr. Ayd. "Instead doctors should be required to alleviate suffering only and not make extraordinary efforts

to prolong life. Most religious leaders support this view."

One of the most widely-publicized cases involving the unresolved issue occurred in Stockholm in 1966 when the famed surgeon, Prof. Clarence C. Crafoord of the Karolinska Institute removed a kidney from a dying woman with irreparable brain damage and transplanted it to a patient with kidney disease. The husband had consented but a furor followed within and without the medical profession.

Dr. Crafoord, defending the operation, said: "A surgeon must feel that it is not his duty to give help to a person whose brain does not function. You are dead when your brain doesn't function any more, not when your heart has stopped beating. When the electrical activity of one's brain stops, as determined by electronic measurements, life is gone and what is left is only a surviving organism which can be used to save the lives of other people who have diseases that are reparable."

The issue is important, Dr. Ayd says, because vital organs needed for transplant can become useless by remaining in the body too long after death. They must be removed as soon after clinical death as possible and as far from biological death as possible.

LSD—a creativity bust

Creativity is believed to be the product of a variety of factors but LSD is not one of them.

Contrary to contentions of some psychedelics that the chemical, lysergic acid diethylamide, opens the door to the deep recesses of man's innate capacities, a Yale University physician has found no positive results after testing volunteer graduate students.

Dr. Leonard S. Zegans tested 31 subjects, some of whom received LSD and others an inert, blank substance.

Each was given an extensive battery of tests before and after taking the drug or the placebo to gauge ability to do creative work. The exercises in imagination included the ability to bring remote and unconnected ideas into some kind of relationship, to see figures hidden in drawings, to make artistic designs out of mosaic tile, to measure original rather than stereotyped responses in word association tests and to lie on a cot and speak aloud any random

thoughts that came to mind. In addition, there were tests for skill in abstraction, for intelligence and personality.

All changes from pre-drug to post-

drug testing were scored. Dr. Zegans concluded:

"The claim that LSD has a potential for increasing creativity cannot be substantiated."

There was a suggestion that LSD, given to certain subjects, may increase the "accessibility of remote or unique ideas to their conscious awareness" but Dr. Zegans warned this could be helpful only in individuals "meaningfully involved in a specific interest." Simply to ingest LSD to see what kind of random creativity might emerge can lead to dangerous anxiety and depression, he said.

"The indiscriminate use of LSD in the hope of improving creative thinking is to be cautioned against," Dr. Zegans added.

Poorest showing of the LSD-takers was on tests requiring visual attention, particularly the mosaic tile design and perception of hidden figures.

Thus, while LSD might bring about greater openness of the mind, it does not help in focusing attention on details.

MD's as addicts

Most physicians dislike treating a narcotics addict, particularly an addict who also is a physician.

"As a patient, a physician-addict is apt to be regarded by his peers as a nest-fouling bird and is apt to be met with hostility, scorn and rejection," says Dr. Charles H. Jones, superintendent of the North Shore Hospital, Chicago.

This is unfortunate, he adds, since many physicians can be rehabilitated, even though it may be necessary for them to change their specialty or to leave the practice of medicine.

Dr. Jones says drug addiction is truly an occupational hazard among doctors because of the ready availability of narcotics. The incidence of physician-addicts has been estimated to be 30 to 100 times that of the general population, both here and abroad. Some 15 percent of known drug addicts are physicians and another 15 percent are members of paramedical groups.

Addiction most frequently appears in the late 30s or mid-40s. Usually the basic cause is a depression.

"The addicts seem to be dependent individuals of superior academic and intellectual endowments who have shown a lifetime of striving for high orders of attainment in the future," explained Dr. Jones. "Finally, however, great expectations of the future become the missed opportunities of today. Life has not turned out as expected. Unattained professional accomplishments, financial problems, practice demands and family complications bring these people into contact with the hurly-burly of life for the first time.

"This leads to depression and despair and ultimately to the socially suicidal solace of narcotic addiction."

They don't want to give up medicine, the physician went on, because their doctor's identity has

been their shield as well as their major source of self-esteem.

Dr. Jones has found that changing specialties can be effective, noting:

"Not only does the physician remove himself from the pressures of active practice but in taking a residency or other training program he finds himself in a familiar situation where he has succeeded in the past. He again becomes a student striving for future goals and this helps him repair his shattered medical charisma."

Two of Dr. Jones' general practitioner patients became psychiatrists and another is a pathologist. A surgeon and a pediatrician became general practitioners and an internist changed to physical medicine.

No bed rest for kids

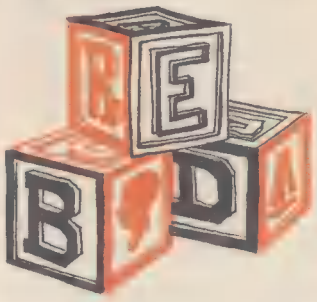
The child with an illness needs rest so you decide to keep him in bed.

Forget it!

A study at Children's Memorial Hospital in Chicago shows that sick youngsters use up just as much energy in bed as when allowed to move about freely.

Doctors Jerome L. Schulman and Harold N. Bass of the Northwestern University pediatrics department acknowledged the finding contradicts the view of parents and most physicians that bed rest is an important adjunct in the treatment of most childhood illnesses.

"What appears to be rest in bed is often only illusory," Dr. Schulman says. "Instead of lying still the child is often found running in the bed itself."



The physicians studied 32 boys between the ages of 6 and 13, some of them on bed rest and others up and about. Activity was measured by means of an actometer, an automatic-winding wrist watch modified to provide a direct drive from the pendulum to the hands. One was worn on the wrist and ankle by each patient from 11 a.m. to 5 p.m.

No difference was found between the total activity time of the two groups.

"Anyone who works with hospitalized children knows that they are happiest when allowed to remain out of bed for a considerable length of time," Dr. Schulman pointed out. "When a very ill child is given a choice he will generally elect to go to bed, getting up only when he is feeling better."

The pediatricians questioned whether some children placed on bed rest actually stay put when the nursing personnel is too scarce to keep a close watch.

Children in the experimental group allowed to be up and about usually visited children in other rooms, walked to the hospital school or spent the time in the playroom on the floor.

Medical science still does not fully understand what bed rest does for the healing process, Dr. Schulman said.

Who gets cancer checkups?

Why do people have, or fail to have, cancer checkups? The American Cancer Society interviewed 2,099 men and women 21 years or older, in 31 cities.

Nongoers feel they are healthy and therefore see no need for checkups. They see little reason for being examined unless something is bothering them. They have had less personal contact with cancer in their family and know few other people who have had cancer. They believe they have a below-average chance of getting cancer. They are less aware of the prevalence of cancer and of the potential for curing the disease. They also are afraid of what they might find out if they went for a checkup.

Goers, on the other hand feel that they are healthy in part because they go for checkups regularly. They look forward to the "good news" that they do not have cancer. They focus on the rewards aspect of checkups.

Nongoers view goers as overly cautious and somewhat hypochondriacal. They are inclined to pin the "Nervous Nellie" label on the goers, even though recognizing that undergoing checkups is a responsible thing to do. Nongoers think checkups cost too much and take too much time.

Hospital dangers

Although the advances in diagnosis and efficiency of treatment have been pronounced, they are still not without hazard in a hospital, conclude J. T. McLamb and Dr. R. R. Huntley of the University of North Carolina School of Medicine.

They conducted a 30-day study to determine the number of "episodes" occurring in a hospital ward that were unintended, undesirable and harmful to the patient. The ward averaged 86 patients.

Results showed a total of 63 reported episodes in 47 different patients.

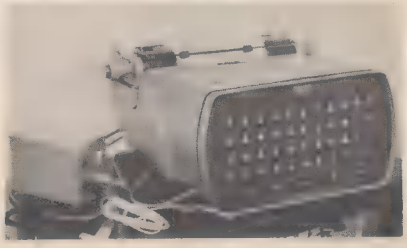
Reactions to drugs accounted for 45 percent of all reported episodes, the authors wrote in *Southern Medical Journal*. Errors in diagnostic and treatment procedures accounted for 27 percent and a variety of ward accidents accounted for the remaining 28 percent. These incidents included falls and assorted errors in medication.

Patients who encountered adverse reactions had an average length of hospitalization of 17.2 days compared to 10 days for the population as a whole.

Typing without hands

It may seem incredible but typing without hands is possible now because of an invention by Hugh Steeper Limited of England. It's a control system developed to give to the badly handicapped environmental control with a minimum of effort and re-education.

The basics of the system are light sensitive cells which can be triggered by a light beam. The beam, once it makes contact, can activate any electric appliance or any facility that is electrically operated. The light beam, or source of light, projects a parallel beam. The gadget, as shown in the picture, can be worn or affixed to spectacles or head bands. It may be adapted to any part of the body where there is a movement of at least five degrees. The only requirement needed is for the patient to align the light beam on to the symbol on the control panel, also shown in the series of pictures, and the control system activates the necessary operation. So, when the light sensitive cells installed in a typewriter are activated by the light beam, the machine starts to function. The light beam must be focused on the letters indicated on the pilot panel. By complete control of the light beam by the operator, it is possible to beam the light on individual letters which correspond to the typewriter keys. Once the beam hits the letter, then the sensitive cell is activated and the typewriter types that letter. The operator runs the typewriter without touching the keys.



Control system for badly handicapped consists of light sensitive cells triggered by a light beam on lady's glasses. Light source can be adapted to any part of body that has minimal movement of five degrees. When light sensitive cells in typewriter control panel are triggered by light they are immediately activated and can set in operation any appliance or other facility electrically controlled. Light beam must be aligned on symbol on the control panel.

MEDICINE

Winning the battle against asthma

Asthmatic children are lifting weights and playing basketball. And they are able to breathe better as a result.

by Dorothy Ducas

A DISEASE that attacks without warning and feels like a giant hand squeezing the throat and chest, causing warning gasps and wheezes and fear of choking, is bound to strike panic into the hearts of its victims and their families.

Such a disease is bronchial asthma, suffered by millions of children and adults in the United States. Yet in most instances today asthma is controllable, particularly if it is brought under good medical care early.

True, some 5000 Americans die every year from asthma and there are thousands so ill they must be hospitalized for long periods. But many people still believe that all victims of asthma must be lifelong invalids. Indeed, they had been routinely put to bed, frequently kept out of school or away from work and, in general, urged to live restricted lives.

Fortunately, for many asthmatics this is no longer the case. In fact, broadening of rehabilitation techniques—especially the employment of body-building exercise and activity—is one of the most hopeful developments in the treatment of asthma. At National Jewish Hospital in Denver, Colorado, a leading center in asthma research and clinical treatment, a study was conducted in which asthma patients, age 15 to 35, who had failed to respond to previous outpatient treatment, engaged in two hours of physical exercise daily. For one hour they engaged in calisthenics: push-ups, sit-ups, weight lifting, and pedaling a stationary bicycle. During the second hour they were allowed to engage in competitive sports such as basketball.

A second or "control" group of patients was allowed to participate only in routine hospital activities without additional physical exertion. At the end of three months the groups exchanged places.

Results: None of the patients studied showed harmful effects from the three months of conditioning exercises and athletics. Three out of four were better able to utilize ox-

The Quantitative Inhalation Challenge Apparatus, developed by Dr. Irving H. Itkin, pinpoints the offending allergens and also determines the amounts that trigger attacks and the location in the bronchial tree where the allergins cause trouble.

ygen after the period of physical conditioning, even when the obstruction to ventilation did not change.

In the case of bronchial asthma, the patient's involuntary breathing function is impeded. As the normal person breathes, the bands of muscular tissue which line the trachea and bronchial tubes contract and release automatically. But when the asthmatic patient experiences an attack, these muscular bands—specifically the muscular bands in the branch-like end-extensions of the bronchial tree—fail to release, or dilate, normally. Peculiarly, the asthmatic can breathe in but cannot breathe out, or expirate, and the characteristic wheezing, coughing, and gasping of the asthmatic attack ensues.

Present research has pretty much dispelled the persistent myth that asthma is psychosomatic in origin.

"I have never seen any proof that asthma, even of unknown origin, comes from emotional disturbances of a high-strung temperament," says Dr. Irving H. Itkin, chief of the Asthmatic Allergy Service at National Jewish Hospital. "Asthma often makes people nervous but nervousness does not appear to cause the disease. Nor does a powerful emotion like sudden fright

bring on typical attacks in asthma patients.

"Fright actually causes the body to release adrenalin which is one of the medications used in treatment to open up the airways. Thus a man frightened of being drafted and sent to Viet Nam is less likely to have an attack during his physical exam than if he were not frightened. Overventilation may be nervous in origin and continued agitation may lead to asthma attacks, but this is not the typical onset."

Organic cause?

Among asthmas of unknown origin he recently discovered a new organic cause—a yeast-like mold in the body to which some patients are sensitive. The mold, called *Candida albicans*, exists in many people but only a few are allergic to it.

A new approach to management of asthma recently was reported by the Boston Children's Hospital Medical Center. Here teamwork between allergists and anesthesiologists provides "ventilator therapy" for asthmatics in the throes of severe attacks.

The anesthetist's knowledge and his special equipment are brought to the patient's bedside as soon as signs of impending obstruction of respiration appear. In effect, if the child cannot breathe on his own, modern resuscitation procedures are instigated immediately.

If the ventilator therapy is not effective in 48 hours, it may become necessary to perform a tracheostomy, to bring air into the lungs through an incision in the neck. But most patients recover within that time, said Dr. John G. Adams, associate in anesthesiology at the Children's Hospital, who is pioneering the application of anesthesiology to the treatment of asthma.

Often allergic asthma may be controlled just by removing the offending allergen. If it is a pollen, and if the patient can move to an environment free of that pollen during its airborne season, that may do the trick. Or if it is a chemical he breathes in the place where he works, he can change his job.

But before such expensive and life-changing steps are taken, the physician must be sure he has found the precise allergen.

Some 20 million Americans suffer from allergies of one sort or another. More than 12 million of these have asthma or hay fever. Patients with a history of hay fever or other allergies are more likely to get asthma than those with no such history. Other allergic disorders include some cases of bronchitis, hives, eczema, intestinal upsets, and sinusitis.

The first thing a doctor does when a suspected case of asthma comes to him is to compile a detailed family history and a record of when the attacks of wheezing have taken place. If the patient comes from an allergic family, this is an indication that an allergy may be involved. If he or his family has kept a diary of when his attacks took place, this may provide clues

to the particular substance or substances causing attacks.

For example, if a child wheezes only at certain seasons of the year but is symptom-free at other times, pollens and molds that are present during those seasons are immediately suspect. If he coughs and gasps when he has been playing with a cat or dog, removing the animal may prove that he is sensitive to its "dander".

Other allergen culprits are house dusts, some medications, and certain items of food such as milk, cheese, and nuts. Food allergies, however, are not as common a cause of bronchial asthma as is popularly believed.

Testing to find particular allergens to which patients are sensitive may be done in different ways. The "scratch" test is most often used, in which a suspected allergen in powder or solution is scratched onto the skin of the arm. If within five or ten minutes a raised wheal—a half-inch in diameter with redness around it—appears, the test is positive. (Sometimes delayed reactions take place and the wheal develops 24 hours later, but not often.)

The same reaction results from injecting a diluted extract of the allergen into the skin—the "intradermal" test. A third way is the "eye" test, in which a bit of dried pollen or dust or other allergen or a solution of the same is dropped into the eye. If the eye reddens and gets teary swiftly, the test is positive. The eye test, however, can only be used for one allergen at a time, while the skin tests can be performed for several allergens in one sitting.

Supervised gym activities are part of the rehabilitation techniques developed and employed at National Jewish Hospital, in Denver, Colorado, a leading center in asthma research and its clinical treatment.

There is also what is known as the passive transfer test. In this case, a volunteer is injected with the serum of the patient and the volunteer is given an intradermal test at the same site 48 hours later.

This is a test used to supplement others as a double-check when the doctor suspects the patient is allergic to material which doesn't show a reaction with the standard tests.

This test may also be used when there is a skin disorder or other illness that would make the skin test inconclusive, or for infants when a skin test would be painful.

Other methods include the observation of what happens to symptoms when a suspected allergen is eliminated from the environment, and also observation of symptoms when the patient is re-exposed to the allergen.

One device is the Quantitative Inhalation Challenge Apparatus, which was designed by Doctor Itkin at National Jewish Hospital.

The name of the apparatus exactly describes the procedure—a direct "challenge" to the patient's allergy. The patient inhales a known amount of allergen or combination of allergens in atomized form. The particle size can be regulated by filters, enabling doctors to control the depth of penetration into the bronchial tree. The quantity of the allergen remaining in the bronchial passages can be precisely determined.

At St. Vincent's Hospital and Medical Center of New York, a unique room with a completely controlled environment has been set up both for therapy and research in the pediatrics department. In this room, temperature, humidity, and particles in the air are regulated and measured so that the three patients who occupy it breathe only known mixtures and the effects are automatically recorded 24 hours a day.

Rehabilitation of the asthmatic encompasses more than the use of exercise and physical therapy, according to Martin Nacman, rehabilitation director at National Jewish. It includes psychological and vocational evaluation, counseling and training, he explains. For the goal of every hospitalized asthmatic should be to return to the normal world equipped to live and work in it successfully.

Emotional problems

Asthmatics, of course, have special emotional problems. Any disease affecting breathing creates fears and frustrations. Psychological assessment of 85 in-hospital asthmatic patients (including 39 who were in the exercise study) indicated that they generally had average intelligence but with neurotic tendencies and immature personalities. They showed interest in work which was either far beyond them or extremely restricted. Yet a follow-up study revealed that 60 of the original 85 patients in the study were maintaining much higher activity levels after they left the hospital—and were either in some educational program or working at jobs.

There are many areas in which scientific researchers have not yet found the answers (for example, what makes some people allergic while others are not?), but much work is going on now in this field and, in time, means of prevention may be found. Meanwhile, the life of an invalid no longer is the prospect for those who suffer from the gasping chokes of allergic asthma.

Idea of the month

Escape cocoon

THERE has been much speculation as to what would happen to the astronauts aboard if an orbiting vehicle's reentry equipment failed. Would they have to go on orbiting the earth forever?

An answer is offered in a patent recently granted to Caldwell C. Johnson, an engineer in the Manned Spacecraft Center of the National Aeronautics and Space Administration at Houston, Texas. Johnson has devised an escape cocoon for use by an astronaut in trouble.

The equipment, a strong nylon bag with an attached retrorocket, is to be kept folded in a compartment outside the spacecraft.

The crewman puts on his extravehicular pressure suit with oxygen supply, leaves the craft, unfolds the escape device, and zips it up around him. He can then orient himself by looking out of the cocoon's windows at some landmark and releasing used oxygen and carbon dioxide from his space suit through the nozzles of the rocket.

When ready, the crewman fires the rocket and thrusts himself in the direction he wants to go. The rocket should be pointed at or slightly below the earth's horizon.

To provide stability before entering the atmosphere, the astronaut inflates bladders and shapes the cocoon into a ball. It has an insulated lining.

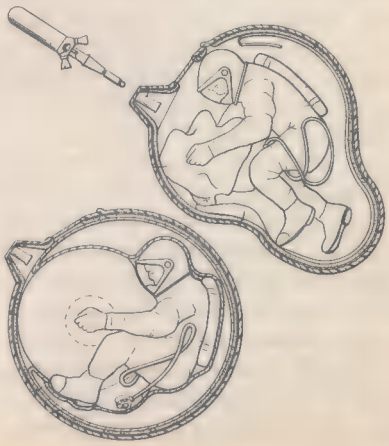
Once under atmospheric pressure, according to Patent 3,330,510, the internal bladders will deflate, giving the occupant notice that it's about time to leave. At 15,000 feet, the shapeless cocoon will be dropping at 200 feet a second.

The crewman unzips himself and lands by parachute. His survival equipment, including a flotation vest, radio beacon, food and water, take care of him until he is rescued.

The inventor has built a partial model and has worked out the procedure and timing—3 to 5 minutes for preparations inside the craft, 12 minutes for the astronaut to settle himself in the cocoon, and so on.

—*Stacy V. Jones*

Below is the patents application drawing of the spaceman's escape cocoon. Vital two steps for re-entry launch are illustrated.



Each month Dr. Isaac Asimov chooses one of the questions you send in to answer. He does not make the job easy on himself, for in past months he has written about such things as relativity, parity and the basic nature of light. Following Dr. Asimov's answer are the answers to some of your other questions written by regular members of the **Science Digest** staff.

In the beginning

How did life begin?

There is no flat answer to that since nobody was around when life began, to serve as an eye-witness. We can make logical analyses of the problem, however.

Astronomers have come to certain decisions as to the general make up of the Universe. They find, for instance, that it is about 90 percent hydrogen and 9 percent helium. The remaining one percent is made up chiefly of oxygen, nitrogen, neon, argon, carbon, sulfur, silicon and iron.

Starting with this and knowing the manner in which such elements are likely to combine, it is reasonable to conclude that the earth at the start had an atmosphere rich in certain hydrogen compounds—water vapor, ammonia, methane, hydrogen sulfide, hydrogen cyanide and so on. There would also be an ocean of liquid water with atmospheric gases dissolved in it.

For life to form on such a world, the simple molecules that would exist in the beginning would have to combine to build up complicated molecules. In general, building up complicated molecules of many atoms out of simple molecules of a few atoms each, requires an input of energy. Sunlight (particularly its ultraviolet content), shining on the ocean, would supply the necessary energy to force the small molecules to form larger ones.

But *which* larger ones?

In 1952, an American chemist, Stanley Lloyd Miller, decided to try to find out. He prepared a mixture of substances like that thought to be present in the earth's primitive atmosphere, and made certain it was completely sterile. He then exposed it for several weeks to an electric discharge that served as a source of energy. At the end of the time, he found the mixture held

somewhat more complicated molecules than those with which he started. They were all molecules of types found in living tissue and included some of the amino acid building blocks of those important compounds, the proteins.

Since 1952, many investigators, here and abroad, have repeated the experiment and added refinements and elaborations. They have built up a variety of molecules by a variety of methods, and have then used those molecules as starting points for still further build-ups.

The substances so formed have all proved to be on the straight highway toward the complicated substances of life: proteins and nucleic acids. No substances have been found that differ significantly from those characteristic of living tissue.

Nothing has been formed yet that can, by the widest stretch of imagination, be called living, but scientists are working with only a few pints of liquid for a few weeks at a time. On the original earth, a whole ocean of liquid was exposed to the sun for billions of years.

Under the lash of sunlight, the molecules in the ocean grew gradually more complicated until, eventually, some molecule was somehow formed that could bring about the organization of simpler molecules into another molecule just like itself. With that, life began and continued, gradually evolving to the present state of affairs. The original forms of "life" must have been far less complex than even the simplest

forms of present-day life, but it was complex enough. Scientists are working hard now to fill in the details of that "somehow" earlier in the paragraph.

It seems quite certain, however, that life developed, not as a miracle, but merely because molecules combined with each other along a line of least resistance. Life couldn't help forming under the conditions of the primitive earth any more than iron can help rusting in moist air. Any other planet, which resembles the earth physically and chemically, would also inevitably develop life—though not necessarily intelligent life.—*Isaac Asimov*

Why is a raindrop teardrop shaped?

It isn't, says Duncan C. Blanchard scientist at Woods Hole Oceanagraphic Institution, in his new book "From Raindrops to Volcanoes" (Doubleday).

A raindrop says Duncan "tends to be flattened on the bottom, rounded on the top, and is wider than it is high."

The common conception of a raindrop is of a tear-shaped object. Why aren't they that shape? "Well, why should they be," retorts Duncan, "any more than they should be triangle-shaped, square shaped, or rectangle shaped?"

Duncan goes on to explain that the shape of a drop is, "controlled by delicate interaction among the hydrostatic, aerodynamic and surface tension forces."

In recent months there has been quite a bit of commotion about rat control. Are rats really that numerous and dangerous?

Emphatically yes! In France there is a saying, "every Parisian has his rat", it now appears that every New Yorker may have his rat too; the one-man, one-rat ratio holds for other large cities as well. Of all the creatures in the world, the rat has probably benefitted most from man's success upon this planet.

It is unknown when man's unwilling association with the rat began, but it must have been a very long time ago for they have been known as pests since antiquity. One account tells of how the Assyrian army was devastated in a single night by a plague of rats which ate all the leather and rope in the camp.

Later the fleas carried by rats spread the plague which devastated the population of Europe.

The most common rat in America at present is the Norway rat, bigger, stronger and tougher than the black rat which it drove out.

The *New York Times* described the Norway rat this way: "They will go anywhere and do anything to get the three-quarters of an ounce of food and half-ounce of water that each needs daily—climbing brick walls with tiny but powerful toenails, swimming half a mile underwater, (often surviving when flushed, alive, down the toilet), walking on a wire, swinging under exposed ceiling beams."

First you must be a genius

The Wind and Beyond; by Theodore von Karman with Lee Edson; Little, Brown & Co. ($10).

For anyone who wants to learn how to burn both ends of the candle, maintain a high degree of popularity with two bitter enemies while peddling services to both (at high prices), achieve fame, wealth and a ripe old age—the formula is here.

The first requisite is that you must be a scientific (at least) genius. Then you must be: compassionate, loveable, endowed with a keen sense of humor, a sharp businessman and top-flight administrator (to name a few of incredible Theodore von Karman's attributes).

Known perhaps vaguely to the

Leonard Nadel

Dr. Theodore von Karman, personage extraordinaire, pictured above just before his death, was noted for endowing everything he did with irresistable charm. Below is a photo of engines and counterrotating propellers of his gyrodyne-type helicopter.

general public, this little Hungarian Jew, born in Budapest in 1881, was famed in the fields of mathematics and aviation as the "father of aerodynamics". He started with balloons and Zeppelins and lived to lead a dozen nations into an era of supersonic aircraft and practical rocketry, with his theories on "drag" and "turbulence".

During WW I he showed Fokker how to fire machine gun bullets through a whirling propeller; then became advisor to Graf von Zeppelin—meanwhile advising England's Handley-Paige on crafty designs for military planes. He established Japan's first aeronautics lab in 1926, then promptly established an aeronautical engineering course at China's Tsing Hua University for Chiang Kai-shek; upon which (in 1929), he assumed leadership of Cal Tech's Guggenheim Aeronautical Laboratory and set up a research blueprint for the U. S. Air Force, which helped guide us to victory over the the Japanese and Germans in WW II!

One gets the impression that von Karman was driven by a compulsion to bestow his genius without favoritism on all mankind. That he did so with staggering success is evidenced by the fact that he was decorated by all the above countries —even after he'd shifted base and loused up a few of them.

This little "gnome of a man with a Mona Lisa smile, sad blue eyes, and a head of wavy gray hair" had the charm and nimble wit it takes to turn the trick.

At an international congress, when a French Scientist, Henri Benard (who claimed he had observed vortices first) objected to the fact that a Paris street had been named Rue Karman Vortex—after von Karman's vortex theory—von Karman jumped up promptly and said: "I don't object if in London this is called Karman Vortex Street. In Berlin, let us call it Karmansche Wirbelstrasse, and in Paris, Boulevard d'Henri Benard."

Benard was his friend for life.

In matters of money, he was tough-minded. When the owner of a German tool factory beefed about a bill rendered by von Karman for advising him to turn a gear 90° to stop the vibration in a piece of machinery, von Karman told him blandly: "Turn the gear back 90° and I will tear up the bill."

His charm, dealt out in a thick Hungarian accent, was famous. When President Kennedy shortly before his death in 1963, reached for the little man's arm to help him downstairs, von Karman snatched his arm away. "Mr. President," he said, "I do not need help going down, only going up." He was 83 years old.

This is a big book about a full life. Professor von Karman provided the genius, and Lee Edson provided the journalistic skill to a degree that led von Karman to remark: "It's me, in English."

And von Karman in any language is *must* reading for anyone who wants to know what makes the world go 'round.—*RFD*

The History and Geography of Diseases. Dr. Folke Henschen. Delacorte Press. ($10).

Did you know that the snake wound around the stick, medicine's official emblem, may originally have been a parasitic worm? Or that some of the great fortunes in Europe were made in the importing of Indian wood as a (doubtful) syphilis cure; that in the influenza epidemic of 1918, 50 percent of mankind succumbed to the disease; that the spread of malaria is likely to have affected the philosophical outlook of Hellenic Greece and that anthrax among the Hun tribes and cattle may have saved Europe? These are some of the nuggets of information that Dr. Folke Henschen, an internationally known pathologist, presents in his fascinating historical and geographical survey of the diseases of mankind. Henschen's writing is non-technical.

The book progresses disease by disease, with a brief description of each, when and where it appeared, how it spread, its various names and how it has been controlled.

Dr. Henschen concludes his backward glance at disease by noting: "We must not forget that the increased frequency of cardio-vascular diseases and tumors, as well as the numerous accidents on the roads and in industry, are indirect results of our much-prized material civilization, and that in them we are harvesting the fruits, for good or evil, of the tree of knowledge which we ourselves have planted and of which we are so proud."

U.S.D.A. Photo

One larva eats another: This parasite of the Japanese beetle is imported by U.S. Dep't of Agriculture to keep the beetle from becoming serious economic threat.

"Silent Spring" Quiz

by John and Molly Daugherty

BIOLOGICAL control of insects offers an alternative to chemical control, a method which sometimes upsets the balance of nature. Perhaps a blending of both methods will provide the best answer to the pest problem.

What do you know about biological control of insects?

1. **The approximate number of insect species imported into the United States for possible biological control totals**
   a. 700
   b. 1,500
   c. 2,500

2. **The first parasitic insect imported intentionally for biological control dates back to**
   a. 1913
   b. 1905
   c. 1883

3. **The most successful biological control project was against the**
   a. Japanese beetle
   b. Cottony cushion scale
   c. Gypsy moth

4. **Birds are well-known predators of insects. Massachusetts' estimated bird population is 25 million. From May to September birds in Massachusetts eat 2½ billion insects a day—about 21,000 bushels. Among the following predators of insects, the one which may exceed the bird is the**

a. Toad
b. Spider
c. Shrew

5. The first effort to use biological control of insects over a wide area in the U. S. began in 1905 against the
   a. Gypsy moth
   b. Wooly apple aphid
   c. European spruce sawfly

6. Domestic animals help biological control. Flies have been controlled by
   a. Geese
   b. Turkeys
   c. Hogs

7. The state authorized since 1899 to import its own parasites and predators for insect control is
   a. California
   b. Texas
   c. Ohio

8. The biological control used for the jack pine sawfly in the province of Quebec is a
   a. Virus
   b. Parasite
   c. Predator

9. The screwworm *Cochlio-myia hominivorax* pest in the Southeastern United States attacks cattle and wild animals. It is controlled by
   a. Parasites
   b. A trick
   c. Predators

10. The Southern cornstalk borer is held in check by
    a. Bacteria (*Bacillus popilliae*)
    b. Chalcid wasp (*Blastothrix longipennis*)
    c. Ant (*Solenopsis xyloni*)

Answers:

1—a 700. Over a span of sixty years only about 95 species became colonized and established. Of these, 81 were parasites and 14, predators. Some of the 700 were never colonized for various reasons, and 390 of them never became permanently established.

2—c 1883. The U.S. Department of Agriculture imported a wasp (*Apanteles glomeratus*) from England to hold the cabbage worm, which originally came from England, in check. Today you find the wasp everywhere cabbage grows in the United States. The wasp is a parasite.

3—b Cottony cushion scale. In 1872 this small insect appeared on citrus trees. Within fifteen years it became a real threat to citrus groves. In 1888 Albert Koebele went to Australia to find a parasite to attack the scale, native to that country. He sent back two—a fly and a lady beetle, the vedalia (*Rodolia cardinalis*). From five hundred of these beetles, imported colonies established themselves within two years throughout the citrus groves in California and held the scale under complete control. Later, chemical pesticides upset this balance, and recolonization was necessary.

4—b Spider. W. S. Bristowe estimates that the spiders of England and Wales eat 220 billion insects a year. The amount in weight exceeds the weight of the people of England and Wales!

5—a Gypsy moth. The ground beetle (*Calosoma syncophanta*), the most important predator against the gypsy moth, was imported from England. It was used in Massachusetts and later throughout New England. By 1927 more than 40 species of parasites

and predators were imported, and over 90 million parasites released. Among the parasites were species of braconid wasps and tachinid flies.

6—b Turkeys. Young male turkeys put under chicken hens' cages eat nearly all the fly larvae and pupae from the chicken hens' droppings. About 800 turkeys can control the flies for 35,000 chicken hens. This method to control flies is safer and cheaper than the use of pesticides. Geese have been used to control weeds in California. Hogs root out white grubs.

7—a California. In general, the Entomology Branch of the U.S. Department of Agriculture supervises screening at a quarantine station to ensure that undesirable insects are not imported. The California operation at the University of California is so extensive that it alone handles about one-third of the imports and maintains an excellent quarantine station. The Federal Government, the State, and the University cooperate in biological control.

8—a Virus. The virus polyhedrosis was found in Quebec and spread by airplane over infested areas in 1961-1962. The virus, suspended in water or oil, was sprayed by the plane. The disease by spreading rapidly controlled the jack pine sawfly.

9—b A trick. The trick was the sterilization of the male screw-fly. The screwworm is the grub of this two-winged fly. The irradiation of the pupae a day or so before the adult screw-fly emerges sterilizes the fly without side-effects. Mass distribution of a vast number of sterilized screw-flies over Florida in 1958 eradicated the screwworm by 1959. The female is monogamous, and because the sterilized males so greatly outnumbered the natural males, most of the matings were with sterilized males. The eggs, therefore, were infertile.

10—c Ant (*Solenopsis xyloni*). This ant checks the cornstalk borer in winter time and usually keeps it from doing serious damage. Bacteria (*Baccilus popillae*)—milky disease—is effective against Japanese beetles. Chalcid wasps control calico scale on walnuts.

Score yourself:

9—10 right—You're flying high.
4— 8 right—You're in good balance.
0— 3 right—Don't let it bug you!

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Freezing controversy

We have received several letters complaining about the many inaccuracies in your articles, "Will We Freeze Ourselves Into the Future?" and "The Cryogenic Underground" by Bruce H. Frisch (June '67). As minor examples, I'd like to point out that we know of no one named Robert Norman in the Cryogenic Societies; Robert Nelson is the president of the Cryonics Society of California. You should also know that Mr. Ettinger is not making a living from freezing. He took one year's leave from his position to help promote the freezing idea, but has been back to work as a physics professor for more than a year now.

More important, however, are the many other misstatements in the article. It is a pity that a magazine such as yours could not have presented accurate statements concerning the freezing of Prof. Bedford as well as the complete picture of research in the field today.

ELAINE ETTINGER
Oak Park, Mich.

Mr. Frisch replies

I admit to muffing the two minor facts Mrs. Ettinger notes. Unfortunately she does not point out "the

many other misstatements". As far as I know there are none. "Will We Freeze Ourselves into the Future" is at present the most complete survey of the freezing subject. I am not surprised that Dr. Ettinger is annoyed with the piece; his articles and book pay little attention to scientific facts. He is selling optimism; I have tried to deal in facts.

BRUCE H. FRISCH
New York, N.Y.

Frozen people

I could not agree with the idea of freezing people, and bringing them back to life years later (Will We Freeze Ourselves Into the Future?, June '67). Even if science can preserve the human body by freezing how can they bring back the life of the individual? What is it that makes a man think and act? Is a man a machine that can be turned off and then on again? Man cannot control the living spirit to the extent he could return it to the body after freezing and thawing.

I am not implying that *Science Digest* accepts this freezing method of preserving life.

WILLIAM TOTTEN
Monroe, Oregon

Yellow journalism?

Do I see shadows of "yellow journalism" infiltrating the pages of *Science Digest?* The cover of the May '67 issue may have increased sales but I ask: Isn't a cover story worth more than 113 words? In articles in other less scientific magazines Ivan T. Sanderson has repeatedly attested to the authenticity of the "Sea Monster" photograph on the cover. If there are any doubts as to the au-

thenticity of the photo, how about telling your readers the basis for doubting? Sanderson is an excellent writer and a romantic naturalist; however, an article by a recognized authority on this photo is now very much required in your magazine.

E. P. BRANDSEMA
Brookline, Mass.

The cover photo was used to illustrate the whole article on real and imaginary monsters. Ivan Sanderson knows more about the history of the photo on the cover than anyone else except the man who took it. That is why we asked him to comment on it. Since even Mr. Sanderson no longer believes the photo to be genuine, further articles on it seem pointless.—Ed.

Bigger than Nessie

Your item on Dr. Roy P. Mackal and the Loch Ness Monster (This Month, July '67) was especially distressing to me. It is not that the Loch Ness Phenomena Investigation Bureau Ltd. should not keep on investigating, but this group is after minnows compared to the huge Leviathan in waters approximately two hundred miles west of the Azores Islands, in the regular shipping lanes. The Loch Ness Monster, according to other articles I have read is not larger than fifty feet, while the mammoth creature of which I am speaking may be over three hundred feet, possibly five hundred feet.

Approximately 1300 hours, 25 June, 1966 while on board a ship enroute to New York I saw this tremendous Leviathan partially surfaced in a calm sea. There was not a whitecap to be seen, when all of a sudden there was a breakwater about a mile distant, as the prow of a ship might make. My first glimpse of the greyish-blue sea serpent came as the long round body emerged from the depths and, like a roller coaster, began descending. This prompted me to believe it might be a whale (many of which I have seen). But as I watched in amazement the continuous emerging and descending for almost a minute, I realized that it was no whale but a sea serpent at least twenty times larger than a whale.

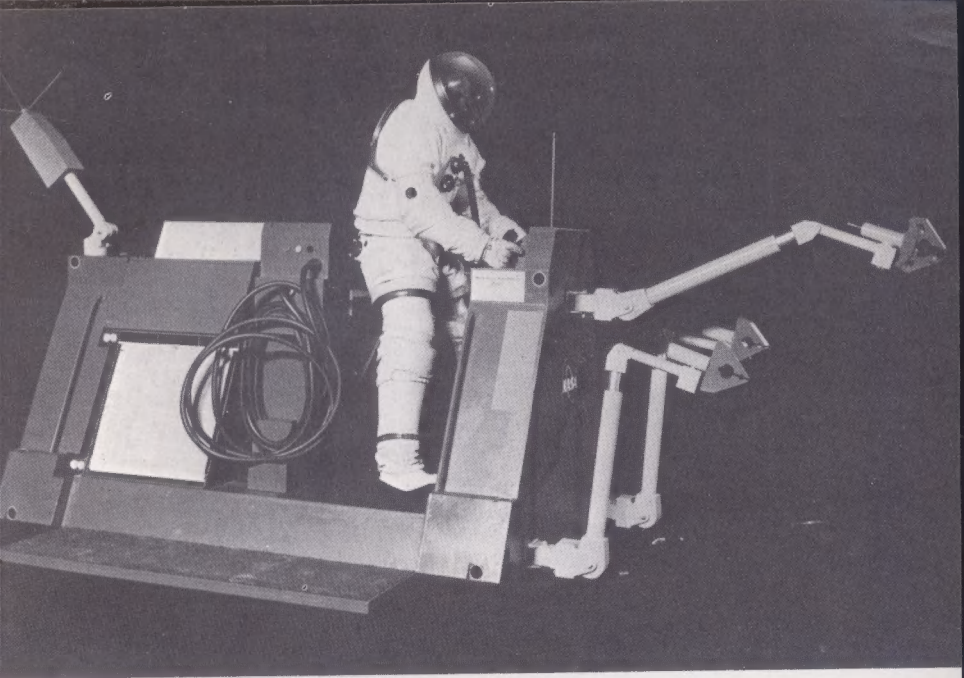
I did not see the head or tail or lower portion of the long round body, but the portion I did see was about twenty feet above the water. It was travelling in the same direction as the liner I was on and at twice the speed. I was so awed by what I had seen that I was speechless and the creature disappeared as I tried to attract another passenger to take a look at it.

HENRY BROWN
Washington, D.C.

Good work

My primary field of academic interest is the natural sciences. Of the four subscriptions that I presently have to science publications, I consider *Science Digest* to be the most valuable, page-for page, penny-for-penny. Often I buy a popular national magazine just to obtain an article or two dealing with natural science. But in *Science Digest*, I have an entire publication of scientific articles, dozens of them, all consistently interesting. I am especially pleased with your numerous psychology articles, since this is my major subject at college. So, applying an old adage to a modern masterpiece, "Keep up the good work." Please!

WILLIAM PRAWDZIK
Philadelphia, Pa.



Mechanical 'horse' for space

OUTER space may become "Home on the Range" for the horsey object pictured above. Although it resembles a horse in construction, the mechanical device is a maneuvering work platform. A concept of LTV Aerospace Corporation's Missiles and Space Division, the work platform also is referred to as an open "space-going tool shop". The space-suited crewman on the platform would use the remotely-controlled grapplers at the front of the device to anchor his vehicle to work sites or to retrieve satellites for servicing.

The vehicle will have its own propulsion system, controls, internal power supply, life support system, communications, displays and other appurtenances enabling it to operate independent of the parent spacecraft. Estimates now place completion of craft for use in outer space in the 1970 to 1980 period.

In addition to the mechanical 'horse' style work platform, LTV has come up with an additional model, the Space Taxi, also designed to operate from a parent spacecraft at construction, maintenance and servicing tasks while in orbit. The Space Taxi is completely enclosed, providing shirt-sleeve environment for the crewmen. Manipulator arms on either side of the Space Taxi would be used by the operator who remains inside the space workshop.

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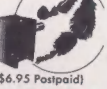

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